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1957

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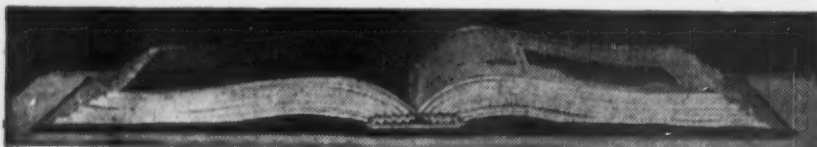
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### Secrets of Life

By Rutherford Platt. New York. 1957. Simon and Schuster. 124 pages. Illustrated in color. \$2.95.

This is a fascinating and beautiful book based on the Disney True-Life Adventure film with the same title. The author served as natural history adviser to the Disney studios in the making of this film, and his text is based upon the film narration by James Algar. This was one of the most fascinating in the notable Disney series and this book enables readers to recall the many startling subjects covered by the film. Insects play a major part in this adventure in Nature.

### Boy's Book of Frogs, Toads and Salamanders

By Percy A. Morris. New York. 1957. The Ronald Press Co. 240 pages. Illustrated. \$4.00.

Amphibians intrigue vast numbers of boys—and girls, too—annually, perhaps because of the interesting life histories of these creatures. This book, popularly written, will bring more order into collection of such specimens and impart essential information about them. Data is supplied as to the proper care of amphibian specimens, where to find them and how to collect. Good illustrations supplement the text as aids to identification.

### The Monkey Kingdom

By Ivan T. Sanderson. New York. 1957. Doubleday and Company. 200 pages. Illustrated in color and black and white. \$6.95.

Primates make up probably the most interesting group in the entire mammal kingdom. Zoo collections of these creatures seem always to attract the most visitors. The author has chosen to use "monkey" in a generic way in his title, which is understandable in view of its popular acceptance. However, monkey is a rather loose term for creatures that are known in zoological circles as primates, and this term takes in a wide and varied group of fascinating animal forms, ranging from the feathertails and tupaia to the gibbons, orangs, chimpanzees and gorillas. This informative, entertaining and attractive volume brings all these animals into focus in respect to their relationship, one to another. The text, as would be expected from Mr. Sanderson, is splendidly written.

### Arctic Birds of Canada

By L. L. Snyder. Toronto, Canada. 1957. University of Toronto Press. 310

pages. Illustrations by T. M. Shortt. \$4.75.

This is a guide to the seventy-two species of hardy birds that are to be found in the extreme northern portions of Canada's northland. This is the area beyond the coast of the Yukon and Mackenzie region, north of an approximate mid-line through Hudson Bay, and north of the southern coast of Ungava Bay. The author is Curator of Ornithology of the Royal Ontario Museum, with which he has been associated since 1917, although Iowan born and educated. While the birds of the Arctic may be

less colorful than those of other areas, their life circumstances are perhaps the most fascinating. From his own long background as an ornithologist, and from the literature of Arctic avifauna, the author has brought together material for an important addition to bird literature.

### Films

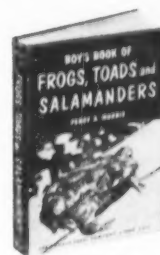
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# Nature Magazine

JUNE-JULY, 1957 VOL. 50 NO. 6

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**Nature Magazine past and present, is indexed in The Reader's Guide in your public library.**



### Fishing with Natural Insects

By Alvah Peterson. Columbus, Ohio. 1956. Entomology Division, Ohio State University, Columbus 10, Ohio. 176 pages. Illustrated. \$6.00.

The author of this interesting and practical book for fishermen is Professor of Entomology at Ohio State University. He has long had a special interest in the recognition and biology of immature stages of insects, an area of entomology about which he has written extensively. As a by-product of this research Professor Peterson has naturally encountered the use of such insects as bait by fishermen, and this book is an angler's guide to these common insects. So far as we know there is no comparable volume, and it is interesting to contemplate the fact that use of this book by anglers is bound to make amateur entomologists out of many fishermen. Surprising, too, is the long list of natural insect bait. The author describes and discusses these in popular terms with a rare combination of insect information and piscatorial advice.

### The American Oasis

By Edward Higbee. New York. 1957. Alfred A. Knopf, Inc. 262 pages and index. Foreword by Fairfield Osborn. \$5.00.

After service as a soil conservationist and agronomist, and after more than 25,000 miles of travel in field research, the author of this book dedicates it appreciatively to "the field technicians of the Soil Conservation Service and to the farmers of America's Soil Conservation Districts." Here we have a significant consideration of the impact of agriculture—our type of highly mechanized agriculture—on our soil resources. In the first part of his book the author considers this impact as represented by the dictates of man, climate and the land itself. The second part of the book considers the agriculture and the situation that prevails in several general geographical areas, including the deserts and irrigated valleys, the west coast, the dry plains and the corn belt. This is a book for the city dweller who should know more about agriculture, and for the agriculturist who may seek to know the whole picture.

### How Life Began

By Irving Adler. New York. 1957. John Day Company. 128 pages. Preface by Linus Pauling. Illustrations by Ruth Adler. \$2.95.

Closely related are the answers to the questions of the nature of life and the origin of life. We know, approximately, when life began on earth, but we are not yet sure how it began. Scientists are beginning to find clues to this mystery. This popularly presented little book competently indicates what we know and what we seek to know, as well as the promise of the future.

### The Wonderful World of the Sea

By James Fisher. New York. 1957. Garden City Books. 68 pages. Illustrated in color. \$2.95.

James Fisher, naturalist and explorer, divides this large-size, beautifully and graphically illustrated book, into four major sections. First he deals with the sea and its waters; then he considers the life within the sea; next he is concerned with the sea and its challenge to man; finally he treats with man's challenge to the sea. In clear and concise text the reader is given a comprehensive basic picture of the sea and its significance; its place in world ecology.



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# Nature IN PRINT

By HOWARD ZAHNISER

## Inheritance Secured and Bequeathed

"LIKE A GREEN ISLAND in an urban sea," writes Nancy Newhall in describing the

Forest Hill Park that rises today between the cities of East Cleveland and Cleveland Heights, in Ohio—a reminder, to those who know, of the taste, the wealth, the foresight, and the generosity of John D. Rockefeller, Jr. So, with only a slightly imaginative projection, might she also describe each of the parks of which she writes in the magnificently manufactured and beautifully designed testimonial volume recently published by Alfred A. Knopf entitled *A Contribution to the Heritage of Every American: The Conservation Activities of John D. Rockefeller, Jr.* For those parks all, it seems, are destined to be surrounded close by the "urban sea" that is inundating more and more of our still-green natural world. Forest Hill Park, the Palisades, the Hudson Valley, Acadia National Park, Shenandoah, Great Smoky Mountains, Grand Teton, Yosemite, Virgin Islands National Park, the Redwoods—all these are "islands" that have been diked against this rising urban sea, substantially or significantly, through the Rockefeller financing and engineering that are honored in this volume. The good work done has been accomplished in magnificence, and it is magnificently memorialized.

A quarter of a century ago I spent a month in and around those eastern suburbs of Cleveland, my father a patient in Dr. George Crile's marvellous Cleveland Clinic Hospital. All unaware then of John D. Rockefeller's contribution, I found it just what the elder Rockefeller, in 1920, had hoped to perpetuate, "a park where people may go for rest and recreation and quiet walks." How many others have known these blessings since, how many had already known them before, I can only speculate. The speculation is the more satisfying as one learns, through Nancy Newhall's account, the Rockefeller family history of this extent of landscape that is now park and

realizes that "here John D. Rockefeller, Jr., under his father's tutelage, first developed his lifelong interest in landscapes and road building." We can well understand that he should be "delighted beyond expression" in the knowledge that people, as he himself wrote, "will be able to enjoy for all time, as I did during the happy days of my childhood and youth, the beautiful area comprised within the Park."

### Forest Hill Park

From this Forest Hill Park beginning on lands that were a family homestead, Miss Newhall, describing a charity that began thus at home, recounts a sequence of investments totalling millions of dollars that have surely brought John D. Rockefeller, Jr., great pleasures in acquisition and proprietorship pro tempore. Beyond this, however, ennobling the indulgence of wealth in a grand and estimable fashion, has been this satisfying expectation of popular enjoyment "for all time."

Along the crest of the Palisades—that "columnar wall thirty miles long" on the western bank of the lower Hudson River—on land acquired by Mr. Rockefeller, in accordance with plans in which he shared, runs the Palisades Parkway. In Acadia National Park, "some sixty miles of roadway and bridges" comprise a road system "to open up the lovely vistas of Acadia to visitors." "For over a hundred miles, the Skyline Drive stretches, like a ribbon down a bright tapestry," along the ridge of the mountains in Virginia where the Shenandoah National Park leads southward to the Blue Ridge Parkway. "A road uncluttered," comments Nancy Newhall, "a road uninterrupted by signs, cities, traffic intersections, and unimpeded by opposing traffic—such a road is a release and a delight," and such roads comprise a significant part of *A Contribution to the Heritage of Every American*.

In the Hudson Valley—where Mr. Rockefeller's contributions have involved Fort Tryon Park with the Cloisters, Philip Castle, Van Cort-

landt Manor, and Washington Irving's Sunnyside; at Williamsburg—where he built a city restoring the Colonial capital of Virginia; and in many museums in parks and elsewhere, millions of people know and will know the interest and delight of learning history and natural history by seeing preserved, restored, duplicated, or represented in miniature and models its very scenes and objects. How in these decades of Mr. Rockefeller's enterprise in philanthropy would these preservations, restorations, duplications, representations have been accomplished but for his noble pleasures in such contributions?

### Wealth not personal

"He rejected," writes Fairfield Osborn in a prologue to this volume, "the delusion that wealth was personal and turned his thoughts and energies toward discovering ways through which the fruits of wealth could be enjoyed by the greatest number of people."

Surely Mr. Rockefeller was successful in finding such ways, and probably most significant of all was his discovery that he, through personal purchase, could acquire what never should have been—and never should be—the property of private individuals, and then could donate and bequeath to the public such marvellous inheritances as the redwoods of California, the sweeping Jackson Hole foreground to the Grand Teton Mountains of Wyoming, sugar-pine forest approaches to Yosemite National Park, white sand beaches in the Virgin Islands of the Caribbeans, and the living wilderness of the Great Smoky Mountains National Park. Building roads and parkways, museums, and even cities is indeed magnificence in enterprise and generosity, but redeeming through personal wealth and determination the very wilderness itself, and through private riches making it in perpetuity a common wealth—this is indeed an exquisite achievement in personal power and philanthropic glory.

As Fairfield Osborn in the prologue, so also Horace M. Albright in the epilogue seems likewise to sense that this contribution to the preservation of our unspoiled native landscape is Mr. Rockefeller's superbly significant public service.

What John D. Rockefeller, Jr., has done through the power of his purse in his time in redeeming from un-

worthy exploitation the wilderness of the Great Smokies (he paid half—\$5,000,000), the redwoods (he paid a third—\$2,000,000—and more), Yosemite sugar pines (he gave \$1,750,000), we the public have the privilege and the challenge in our time of continuing—through our opportunity as citizens for preserving these areas and securing the preservation of still others that yet remain in our public ownership.

### For wilderness

It is interesting to recognize that a quotation with which Horace Albright closes the next-to-the-last paragraph of his epilogue, and thus the book, comes from an editorial that, facing current and real issues in preservation programs, pointed up the desirability of establishing on a statutory basis a national wilderness preservation system, as is now being proposed in the wilderness bill introduced by Senator Hubert H. Humphrey, Representative John P. Saylor, and others.

To the reader of this volume who has been inspired by the contributions of the Rockefellers, the challenge to support such preservation seems strong indeed. The quotation that Mr. Albright makes—from the *New York Times* editorial of April 29, 1956, entitled "Man Needs Nature"—is as follows, stating the need simply and persuasively:

"As our urban, mechanized society spreads itself with increasing speed and destructiveness across the land, the human need for preserving contact with natural areas, with living, wild and growing things, becomes more explicit and more pervasive. As natural areas rapidly diminish, the battle to keep the best of the remaining ones intact grows more intense."

Closing the volume, then, Mr. Albright says: "I think this book will have achieved its mission if it leads others to just one conclusion, with regard to their common heritage, that Mr. Rockefeller reached long ago: 'I believe that every right implies a responsibility; every opportunity an obligation; every possession a duty.' " In so commenting he himself helps make certain the achievement of the mission.

Here indeed is a handsome volume, as handsome in its own way, one might suggest, as the contribution it represents. Nancy Newhall's text is concise and, scattered through the the volume, deals as much with

photographs that comprise most of description and interpretation of the sites of the Rockefeller generosity as with accounts of the contributions. The photographs are all superb. Many of them are full-page or full-spread in size, and many are in color. A dozen full-page graphic maps in color are exquisite in both beauty and clarity.

*A Contribution to the Heritage of Every American: The Conservation Activities of John D. Rockefeller, Jr.* Text by Nancy Newhall. Prologue by Fairfield Osborn. Epilogue by Horace Marden Albright. New York: Alfred A. Knopf, 1957. 179 pp. (9 by 12 3/4 in.). With end-paper color photograph of Yosemite by Ansel Adams, 223 photographs (31 in color), and 12 graphic maps in color. Boxed. \$13.50.

### Seed on the Wind

By Bill Geagan. New York, 1957. Coward-McCann, Inc. 192 pages. Illustrated by the author. \$3.00.

This is the third book by this author on the pleasure of association with Nature. He directs it primarily to fathers in the hope that they will find in it inspiration to go into the outdoors with their sons and teach them the way to behave in those outdoors. It is Bill Geagan's conviction that such a training will result in no "problem boys" and in no delinquency. Bill's nephew, Terry, was suddenly left motherless and Uncle Bill took the youngster into the forest to aid him in outdoor orientation. A lot of dads would benefit by this book, with the end result that a lot of sons would, also.

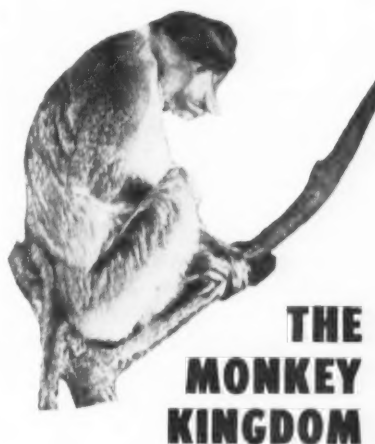
### The Wonder of Snow

By Corydon Bell. New York, 1957. Hill and Wang, Inc. 269 pages. Illustrated. \$5.00.

For a phenomenon as familiar as snow there is an amazingly small amount of popular literature about it. Its study is comparatively recent and much of the result of such investigation is presented in scientific terms and published in scientific journals. Thus snow is one of the most beautiful and at the same time most mysterious of the meteorological manifestations. From the microscopic magic of the individual snow crystal to the impressive activity of a blizzard, snow covers a wide range of interests. In this readable and informative book the author delves into the mysteries of snow with fascinating results for the reader.

## Did you know...

- marmosets have a language, in the truest sense of the word?
- the most ancient species of monkey is still virtually unaltered, after 60 million years?
- only four out of the hundreds of species of monkeys can actually hang by their tails?



by IVAN T. SANDERSON, author of *Living Mammals of the World*. Illustrated with 75 photographs (35 in full-color) and 12 line-drawings by the author. Maps.

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## Weather

*By Paul E. Lehr, R. Will Burnett and Herbert S. Zim. New York. 1957. Simon and Schuster. 156 pages. Illustrated in color. Paper-bound, \$1.00; hard-bound, \$1.95.*

This is the latest addition to the Golden Nature Guide series, which provides introductions to several fields of Nature interest. This most recent book is a guide to the various phenomena of weather and to the mechanics of forecasting. A great deal of interesting and practical information is concisely given here.

## Briefly Noted

*A Naturalist in Palestine. By Victor Houells. New York. 1957. Philosophical Library. 180 pages. Illustrated. \$6.00.* Popular story of nine months of wandering across Palestine by an observing naturalist.

*Man against Germs. By A. L. Baron. New York. 1957. E. P. Dutton and Co. 320 pages. \$4.50.* A dramatic report on man's war against cholera, tuberculosis, leprosy, bubonic plague, syphilis, typhoid, dysentery, poliomyelitis, smallpox, yellow fever, influenza, typhus, rickettsia and "Q" fever.

*Dust for the Dancers. By Beth Dean and Victor Carell. New York. 1957. Philosophical Library. 214 pages. Illustrated. \$6.00.* Exciting and unique adventure among the aborigines of northern and central Australia.

*A Guide for Games. By D. Cyril Joynton. New York. 1957. Philosophical Library. 302 pages. Illustrated. \$7.50.* Practical material intended for those in charge of the physical education of boys and girls aged 8 to 18.

*African Adventure. By Donald I. Ker. Harrisburg, Pa. 1957. Stackpole Co. 248 pages. Illustrated. \$5.00.* A book about both hunting and photographing the wildlife of Africa.

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## AMONG OUR AUTHORS

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# Contents noted

BY THE EDITOR

**REGULATION OF OUTDOOR ADVERTISING** on the 41,000 miles of limited access, interstate highways to be built under the Federal Highway Act looked rather hopeless as this is written. The Senate Committee on Public Roads, after extended hearings, was still struggling to bring out a regulatory bill. But the House of Representatives shaped up as a dead-end street. Chairman of the sub-committee of the House Committee on Public Roads is George Fallon, Democrat of Maryland, who lists himself in the *Congressional Directory* as a partner in an "advertising sign business." He stated that he had no intention of calling a meeting of his committee on the question of regulation of outdoor advertising. He said it was a matter for the States, thus espousing the line of the outdoor advertising industry. Maryland threw out regulation legislation. The ranking Republican member of the committee is Congressman Harry McGregor of Ohio, who is opposed to telling farmers they cannot paint signs on their barns. It is not impossible that both these gentlemen may find they made an unwise decision in 1958.

**PICTURE WINDOWS KILL** was the title of an item in our April issue. It called for suggestions as to how to solve the problem of birds dashing themselves to death against this architectural development. John K. Terres, editor of *Audubon Magazine*, provides a solution in his book *Songbirds in Your Garden*. He says that sheerest nylon marquisette, stretched tightly across the window area, and secured by a narrow strip of molding around the outside of the window frame, will absolutely prevent birds from striking the window. Such an installation does not obstruct the view of the home-owner. The material needs to be renewed every two or three years, which is a small investment in saving the lives of many small birds during a year.

**PROTECTION OF MOURNING DOVES** failed in California this year, although it aroused wide interest and support. Proponents of placing the dove on the protected list presented such strength that the sportsmen's organizations went into high gear to protect their right to use these beneficial birds as targets. However, the issue is by no means dead in California. In Nebraska the biennial move to remove the dove from the protected list was again made. Under the inspired leadership of Mrs. Herbert Weston of Beatrice, Nebraska, farm organizations, many newspapers, bird enthusiasts, garden

clubs, many educators, and just plain citizens rallied around to stop the drive. The legislators heard plenty from the folks back home, and the Senate Agriculture Committee put the bill back in a pigeon hole by a vote of five to two. Meanwhile Guy Atherton of Conservation Militant, St. Paul 2, Minnesota, is keeping up the fight and steadily gaining recruits and reports Montana added to the dove-protecting list.

**THE THODORE ROOSEVELT CENTENNIAL** will be observed in 1958, which is the one-hundredth anniversary year of the birth of "T.R." Many facets of his life and varied interests will have their part in the observances carried on under the general direction of the Theodore Roosevelt Centennial Commission, which was established by the Eighty-Fourth Congress. Important among these interests, of course, will be conservation, for "T.R." was the first President of the United States truly to comprehend the importance of resources conservation. The Natural Resources Council of America, an alliance of national conservation organizations, is cooperating closely in this phase of the observance. It is hoped, also, that the present Congress will pass a resolution establishing a companion commission to commemorate the 1908 Conference of Governors, called by Theodore Roosevelt to consider problems of conservation. The two observances go hand in hand, each accentuating the other.

**"HEEDLESS HORSEPOWER"** is the title that the Travelers Insurance Companies give this year to its annual booklet on street and highway accidents. As always effectively presented, this publication gives us the frightening data on the killing and maiming that goes on annually on our highways. Forty-thousand persons died in automobile accidents in 1956, an increase of 2200 over 1955; 2,368,000 were injured, an increase of 210,000. Charts list the causes of the accidents in a general way and exceeding the speed limit is credited with the greatest fatality. Passenger cars were involved in 79.2 percent of the fatal accidents, and in 96.4 percent of such crashes vehicles were apparently in good condition. Fatalities occurred in clear weather in 85.4 percent of the cases and under dry driving conditions in 80.8 percent. In 75.2 percent of the fatal accidents the cars were going straight. To our mind all these cited data lend definite support to the fact that highway advertising has a direct relationship—through its distraction of attention from the serious business of driving—to highway fatalities. It is the rare driver who would admit that he was looking at a roadside sign, and the dead driver cannot do so. It is time for a serious and unprejudiced study of the percentage of accidents occurring along stretches of sign-infested highway and along comparable miles of protected highways. And an effort should be made by investigators to ask those drivers still extant after an accident whether they were reading the messages of the roadside parasites.

R.W.W.



# The Amazing Air

By JOHN H. DAUGHERTY

*Illustration by John Peyton*

Man lives at the bottom of a great ocean of air, the upper limits of which blend into the vacuum-like world of space. Although this ocean extends out from the earth's surface several hundreds of miles, gravitational force holds about half of it, by weight, within three and one-half miles of the earth's surface.

SEVERAL YEARS ago, a jet air stream high over the United States made the headlines in the daily papers. This amazing river of fast-moving air was 400 miles wide and 15,000 feet deep, and its lowest level was 25,000 feet above that of the sea. The velocity of the air stream was clocked at from 100 to 180 miles per hour.

Jet streams are not unusual, but this one was of great extent—from California to the Atlantic. Its course was plotted with small balloons outfitted with automatic radio transmitting instruments, and provided with parachutes to return the equipment to the earth. The extent of the air stream was verified by jet pilots flying as high as 40,000 feet. Plotting of jet air streams has been going on since the close of World War II, when they were discovered by aviators flying on military missions. Their origin is still a mystery, and they seem to have no effect on the weather. But the answer to these questions is being sought by an Air Force meteorological survey called "Moby Dick."

We live at the bottom of an ocean of air that extends a great distance above the earth. How far, no one really knows. In 1949, a Wac Corporal sounding rocket fired from the nose of a V-2 rocket reached an altitude of 250 miles. This flight was well into the ionosphere—a layer of the atmosphere. Whether the air extends another 1000 miles or more depends upon what we mean by the top of the atmosphere. This is because of the nature of air and the gravitational pull of the earth upon it.

In solids and liquids, the particles of matter that we call molecules cling together; but in gases like air, they are so far apart that there is no attractive force between the molecules. They spread themselves over as large a space as possible. For example, if the pilot light on your gas stove goes out, you soon detect the odor of gas throughout the room.

But molecules of air do not have their own way entirely in trying to fill all space, because of the force of gravity. This force holds about one-half of the air, by weight, within three and one-half miles of the earth's surface. Gravity is the force that gives you weight and keeps you on earth—a force that has enabled the earth to keep most of its air around it for millions of years. Probably some of the outermost molecules *do* escape into empty space. But the number of molecules in the upper reaches of the atmosphere are so few that the degree of vacuum is greater than any man has so far created. Certainly there is no such definite boundary between atmosphere and space as there is between land and water.

The atmosphere may be classified into three general zones, although a fourth has recently been suggested. The zone closest to the earth has an average height of about seven miles, but it may vary from five to ten miles, and is thickest over the warm equatorial regions. It is called the troposphere, and is the region of our weather-factory, with its cloud formations and turbulent air currents. It is in the troposphere layer that we find

most of the dust, smoke, bacteria, and water vapor.

Fine particles in the air serve an important purpose. Without them, there would be no hygroscopic, or water-loving, nuclei for water vapor to condense on and form clouds. Dust particles in the troposphere also scatter light to give the sky its characteristic appearance. At higher and higher altitudes, dust diminishes and the sky turns a darker blue, then purple, and finally black where dust is absent, and the stars shine as though it were night. As you ascend to this region, the temperature falls about one degree Fahrenheit for every 300 feet, depending upon how dry the air is.

The second zone of the atmosphere, which is actually more like a layer, is called the stratosphere. It is separated from the troposphere by a brief transition zone called the tropopause. The stratosphere extends from seven miles to a possible sixty miles. For a long time, man believed that this region maintained a constant low temperature of  $-67^{\circ}\text{F}$ . Now it has been found that this is true only up to twenty miles; above that the temperature begins to rise again, until at thirty-five miles it is about  $180^{\circ}\text{F}$ . After that, further increase in altitude shows a decline in temperature to  $-27^{\circ}\text{Fahrenheit}$ .

As we pass into the third zone, called the ionosphere, about sixty miles up, the temperature has already begun to rise again. At 100 miles it has been calculated to be more than  $500^{\circ}\text{F}$ ., and at around 200 miles, at least  $1500^{\circ}\text{F}$ . How much higher does the temperature of air molecules rise? It is estimated that temperatures may rise above 24,000 degrees Fahrenheit. At these high altitudes, however, our ideas of temperature need to be revised. The air is so thin, the molecules so far apart, that the usual conduction of heat to an object by air ceases to exist. These startling temperatures refer to the state of molecular activity of air molecules. At high altitudes, the warming of an exposed object depends upon the solar radiation it receives, very much like warming yourself before an open fireplace. You feel the direct heat as you face the fire, but your back may be cool because radiation travels in straight lines.

The ionosphere is a region of intense electrical activity. The air particles are ionized—charged positively and negatively. Ultra-violet radiation and cosmic rays knock electrons from air particles, splitting some molecules into atoms and leaving behind both molecules and atoms of air, which are highly charged. Four layers of electrically charged air have been recognized in the ionosphere, each stronger than the one below it. The top layer, known as F2, is more than 220 miles above the earth.

A fourth zone of the atmosphere has been suggested—perhaps 400 to 500 miles up. This has been defined as the region where the upper limits of the ionosphere blend into the space world, a vacuum-like void. But little is known of this region; we must await future rocket flights, and the coming launching of the first satellite by man to encircle the earth.

Of course, there is no fixed line or sudden change as we pass from one zone to another in the atmosphere.



Resistance offered by the air makes the jump of the paratrooper possible by slowing the rate of his descent.

For example, most clouds are in the troposphere close to the earth, but there are a few special types of clouds found in the lower stratosphere, composed of ice crystals, or possibly volcanic or meteoric dust. These noctilucent (night) clouds have been observed at night just after the sun has gone below the horizon. They are about fifty miles above the surface of the earth.

Air is a mixture of gases. The percentage composition of the mixture varies slightly at different places over the land or sea. In general, every 10,000 cubic feet of air contains 7800 cubic feet of nitrogen, 2100 of oxygen, ninety-four of argon, three cubic feet of carbon dioxide, and small amounts of rare gases like helium and neon. In addition, air contains variable amounts of water vapor and a wide assortment of solid particles, such as dust, salt, and combustion products. Wind-whipped waves on the ocean, with the help of evaporation, makes possible the addition of salt particles to the air. When the percentage of gases in the air is calculated by *weight*, instead of *volume*, the results are different because the gases have different densities. That is, one cubic foot of oxygen weighs more than a like volume of helium.

Air is quite elastic—the spring of the air is as apt an expression as spring in the air. It can be compressed readily. The weight of many miles of air above us compresses the air that is closer to the earth. At sea level, when the temperature is  $32^{\circ}\text{F}$ ., one cubic foot of air weighs only .0807 pounds. Yet because there is so much air above us, the force on a sheet of typing paper is more than 1300 pounds. This force on a unit area of surface is called air pressure. The pressure on one square foot of your back is about 2000 pounds. You are unaware

of this tremendous force because there is an equal pressure on every square foot of your body. However, you notice changes in air pressure; if you fly at an altitude of 18,000 feet, the pressure is only 1000 pounds per square foot—one-half that at the surface of the earth, because approximately half of the air by weight is above you. Pressurized cabins on commercial planes are designed to reduce the discomfort of high altitude flying.

Your body is adapted to live in the normal air pressure of your environment. In Peru, there are Indians who have lived at elevations of 10,000 feet or more for centuries. Their unique chest and heart development shows that biological adaptation to living in a rarefied atmosphere has taken place. These Indians have large barrel-shaped chests and long thick hearts, which must work harder to obtain sufficient oxygen from the air under such reduced pressure. Mountain sickness from high altitude is unknown to them.

Changes in air pressure accompany changes in the weather. When storms approach, the barometer falls. This decrease in air pressure seems to affect our body organs. Just how it does this has not been fully established, but there is some evidence that it increases the water content of body tissues. If you have arthritis, with chronically sensitive joints, a decrease in air pressure may cause swelling of tissue from the increased water content, giving you increased pain. You may actually predict stormy weather before it arrives, and changes in weather probably produce more subtle effects upon our moods and emotions. Some day we may know how these really affect us as truly as we know how diet affects our bodies.

Air has many properties that are useful, indeed essential, to life. Oxygen, from the air you breathe, diffuses through the lining of your lungs into the blood stream. Even the nitrogen in the air that you do not use serves a useful purpose—it dilutes the mixture of air. Under normal atmospheric pressure, you could not live if the percentage of oxygen were near 100 percent instead of the ordinary twenty-one percent. Of course, in certain diseases the normal diffusion of oxygen through the lung walls is not sufficient to supply the oxygen the cells need. In that case, an oxygen tent may be used to increase the concentration of oxygen. Oxygen that reaches the blood stream is carried to the cells of your body where digested and stored nutrients are oxidized to supply body heat, release energy for muscular activity, and perform other essential body functions.

The paint on your house would not dry without the help of oxygen in the air, since the linseed oil in outside house paint is slowly oxidized by it to form the hardened

coat of paint. Usually some *drying* oils are added to hasten the process. These oils dry by evaporation; paint thinners like oil of turpentine evaporate. However, some oxidations are a nuisance to man, like the rusting of iron and steel. To prevent this, man uses paint, coatings of tin or zinc, and alloys that are not affected by oxygen.

Although air is colorless, odorless, and tasteless, when it is absent from the water you drink, you notice it. A small amount of air dissolves in water. You can see bubbles of air rising in a pan of water being heated long before it boils. If you have had occasion to drink water that has been boiled, it tastes flat because the dissolved air has been driven off. According to legend, tea-drinking began in the Orient because water, boiled to be safe for drinking, was so unpalatable. Most fruit juices taste better when you aerate them first by shaking them in a cocktail shaker.

Even though water itself is a compound of hydrogen and oxygen, fish cannot take oxygen directly from water, but must rely on oxygen from the air that has been dissolved in it. Although green plants in water help to replenish the oxygen, much of it comes from the wind whipping up waves. One reason the Mediterranean does not equal the North Sea as a fishing region is that the Mediterranean is not so well aerated. Wave action is not as great.

Air, with relatively vast spaces between its molecules, can absorb water vapor. The warmer the air, the more water vapor it can hold. When moisture-laden air is cooled, precipitation occurs. This is important in the distribution of solar energy received by the earth. It takes tremendous quantities of heat to evaporate water that the air absorbs. Winds may carry moist air to cooler regions, where it rains or snows, because cool air cannot hold as much water vapor as warm air. But when it rains, the heat previously absorbed is released. Tropical regions maintain rather constant temperatures year after year because solar energy is distributed to other parts of the earth by this process.

Most substances expand when heated, and air is no exception. In fact, gases expand more with an increase in temperature than either solids or liquids. This, too, helps to distribute the energy received from the sun, because it promotes circulation of air by our wind system. Cool air is more compact, molecules are closer together, and a sample of it weighs more than an equal sample of warmer air. Therefore, dense cool air can move under warmer air and push it to higher elevations. The rotation of the earth causes cool air with its greater pressure to move warm air horizontally, too, in definite



In 1949, a Wac Corporal sounding rocket reached an altitude of 250 miles.



Peruvian Indians, accustomed to living at elevations of 10,000 feet or more for centuries, have large barrel-shaped chests.

wind patterns, causing "weather" changes.

You make use of many of the properties of air. Because air can be compressed, and because its molecules are in constant motion, it can be used in the tires of your car. To say "put twenty-eight pounds of air in my tires" means to fill them with air until the pressure gauge reads twenty-eight pounds per square inch. But the actual pressure inside the tire is really forty-three pounds—twenty-eight more than the normal air pressure outside of the tire, which is nearly fifteen pounds per square inch.

Just how does air support the weight of your car? Molecules of air are in *constant* motion—millions of them strike the tire walls every second. The total effect of all these impacts creates pressure, somewhat like firing a machine-gun against a target to which is attached a device for measuring the force of impact. A steady stream of bullets will register a steady pressure. However, there is a big difference between machine-gun bullets and air molecules. After a bullet is fired from a gun it is spent, but air molecules are elastic. They hit the tire wall again and again without any loss of energy.

After a long drive, your tires become warmer and heat the air inside, and the tire pressure may increase three or more pounds. This is caused by an increase in the velocity of the air molecules, which then strike the tire walls with greater energy. The heat energy absorbed by the air shows up in the form of increased speed of the molecules. In fact, heat is described as molecular motion. The buoyancy effect of water is well known. It is much easier for you to lift a heavy stone while it is under water than when it is lifted out into the air. Since we live at the bottom of an ocean of air, it exerts a buoyancy effect, too, on everything around us. Of course the effect is not so great as that of water because the density of air is much less than that of water.



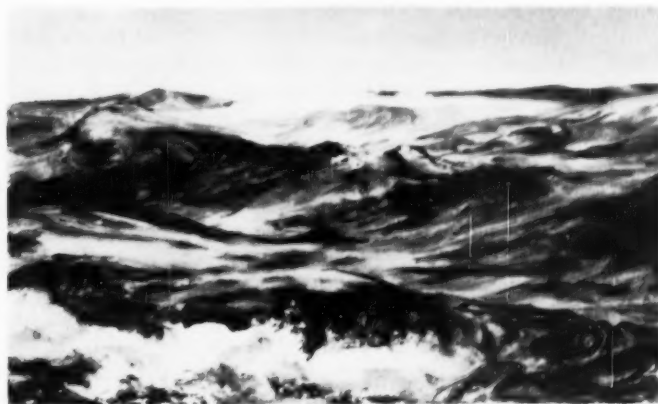
The air a balloon displaces weighs more than the gas it contains, so that the balloon is buoyed up by the air around it. Your body is buoyed up by air, too. If you were on a reducing diet you might be dismayed to realize that without the air around you, your weight would increase—but only by one-fifth of a pound for the average-sized person!

Air is not very dense, its molecules are far apart, and you have little difficulty in walking in it. In fact, you are hardly aware of it at all, unless a wind is blowing. Even so, air is a substance and it does occupy space, so if you try to move it suddenly or move it rapidly, it offers resistance. The resistance offered by air makes the jump of the paratrooper possible; the weight of the man and his parachute is not great enough to move such a large volume of air under the umbrella-shaped parachute except at a slow rate of descent. Your car meets considerable air resistance when you drive at high speed, and designers partially streamline cars to reduce air friction. But stream-lining really becomes essential at the much higher speeds of an airplane, and millions have been spent in research in an effort to reduce air resistance.

Air is so commonplace that we are apt to overlook its unusual properties and their importance to us. It aerates land and water; it surrounds us throughout life and, indeed, makes life possible. Its transparency to radiation from the sun permits us to receive light and heat; its adaptability to man's needs makes it possible for man to put it to work for him. It is indeed an *amazing* air in which we live.



Much of the oxygen of the seas comes from the action of the wind whipping waves into the air.



# Gentlemen of the Jungle

By S. V. O. SOMANADER

Photograph by the Author

**P**ROLONGED DROUGHTS are not common on the island of Ceylon; but when droughts *do* occur—especially in the island's dry zone—grasses disappear, trees become parched and brown, and, because of the scarcity of water in wells and reservoirs, irrigation tanks and rivers, it is a time of difficulty for nearly all living things.

One such recent drought, of many month's duration, was of such severity that it not only caused discomfort and inconvenience to the human population, but also was responsible for many deaths among the island's cattle, buffalo, and other mammalian population. Elephants, however, although suffering in common from the terrible effects of the rainless time, got on better because they are expert water-diviners; and, because of their great strength and weight, they are good water-diggers.

The herd of wild elephants pictured here was in search of water, invading the airstrip precincts of the Gal-Oya valley, site of Ceylon's greatest irrigation project, where a supply of water is certain even during the most difficult times. The herd visits this locality regularly during the evening, after a day's feed, and goes about in quest of water, congregating in the vicinity of deep pools and water-holes, often far from the browsing grounds, to seek out whatever water is available.

When the sandy beds of rivers and other watering-places run dry during prolonged droughts, these lordly beasts of the jungle, after "divining" the places where underground water is likely to exist, dig the ground with a few kicks of their forefeet to a depth of two or three feet; and, when the water seeps up into the cavity, help themselves to the vital liquid. During this process of water-seeking, apart from showing resourcefulness and intelligence, they are often found to be quite chivalrous; for these elephants allow the other unfortunate and helpless mammals like the sambar, spotted deer and buffalo to have their fill either before or after they drink

themselves, defying the usual notion of "jungle law."

There is, in Ceylon, a recorded story of a wild elephant that had dug a hole in the dried-up bed of the Menik Ganga (river), at the Ruhuna National Park in south-eastern Ceylon. As it was about to slake its thirst, a wild buffalo cow—apparently impatient and half-mad with thirst—came staggering across the sand right up



A herd of wild elephants moves along a jungle plain in search of water during a time of drought, after the day's feed in Ceylon's Gal-Oya Valley.

to the improvised water-hole.

Although the buffalo cow was on the point of exhaustion, she boldly stood before the huge water-digger, and seemed literally to be pleading in mute despair, looking hard into the elephant's face, until it appeared to be almost hypnotized. Instead of driving away the bovine intruder, as it might easily have done, the great fellow, with an instinctive graciousness, stepped aside politely, as much as to say, "After you, madam! Thy need is perhaps greater than mine!"—and let the lady drink first. After the buffalo cow had moved away satisfied, the gallant elephant helped itself to its heart's content, and strolled off in another direction.

Who said the age of chivalry is dead? It is not a thing of the past; at least, not among the gallant and knightly monarchs of the Ceylon wilds.



## SMALL FLYERS

*The bees, those intergarden missiles,  
Now make their thin propellers hum*

*To landing fields of flowers and thistles  
More certain of their goal than some.*

*Daniel Smythe*

# The Saga of Mike and Ike

By CHARLES E. GILLHAM

*Photographs by Olin Mathieson Chemical Corporation*

I HAVE always been a soft touch for panhandlers, stray dogs, and orphan "critters" of any kind. One of the stenographers said: "Look at the two little quail. They will die out here in the hot sun."

"They are not quail," I told the two gals, who were sneaking out to take a coffee break at the beanery around the corner. "They are whippoorwills."

Huddled on the sidewalk, before our uptown office, were two little birds, blinking their nocturnal eyes in the 100-degree heat. They had an air of patient resignation on their serious little wide-mouthed, frog-like faces. Lurking alley-cats would never allow them to see another day, even were they able to survive the sizzling temperature. Their parents could never reclaim them and carry them to safety, away from the four-lane traffic and over walls of brick and concrete.

"Poor little things," said Betty. "I guess they fell out of this tree." She pointed towards a lone cottonwood a foot in diameter that had, somehow, survived the inroad of a paved sidewalk and an alley.

"They don't nest in trees," I told the girl. "Whippoorwills nest on the ground." Had I not been a biologist with twenty years in Arizona and Alaska behind me? I had worked in the United States Fish and Wildlife Service in a division with the abbreviated title of "Distribution and Migration of Birds."

Smart people do not disturb the young of wildlife. One does not pick up a stray fawn when it invades a picnic table in the woods. The mother is usually close by. In like manner, little birds of near flying age are usually cared for by anxious parents once one removes his human presence and gives them a chance. It is illegal to possess most forms of wild creatures, anyway, without a permit. But something had to be done, or I would have two little whippoorwills on my conscience. I took them to my air-conditioned office and placed them in a cardboard box. They chirped contentedly, squatting on their short legs. They seemed to trust me implicitly, and naturally that did not make me feel any better.

I telephoned a nearby city zoo, which declined the



The neighbors watched in amazement as the author chased grasshoppers with an insect net made from a coathanger, to provide food for Mike and Ike.

custodianship of the little birds. They admitted they had a large birdhouse, but pointed out that whippoorwills only fed on the wing. At dusk, until black dark, they caught flying insects in their wide-open mouths. It was questionable whether they could survive. In addition, the zoo was interested in exotic birds.

A call to the State Department of Conservation brought more interest. They gave me the names of two local officers who would take them off my hands, but both were away. It was Friday afternoon. I was stuck! I named the whippoorwills Mike and Ike, for they looked alike, and, with some qualms, I took my feathered friends home with me.

My wife, Virginia, was not too pleased to have Mike and Ike. She had some reason for her lack of enthusiasm, for at that particular time we were overstocked with animal life. My daughter had left home only a few months before to attempt to crash the foot-lights of Broadway. She had left behind, in addition to a disorderly room, an alley cat, named George. She had found this skinny, meowing creature in our backyard.

How were we to know that George would have six mottled kittens and, in spite of cat food, milk, and loving care, would die? Virginia was feeding this motley crew with an eye-dropper.

To complicate things, a friend had shipped us from Pennsylvania a dachshund, named Duchess. The sausage dog was doing little to make herself welcome. The papers we spread for her were shredded to the consistency of confetti. She barked at 5 A.M. because she wanted to play. We kept our shoes on top the dresser and the television, and twice my wife found her girdle in Duchess' bed. Naturally we were a bit frazzled when I brought Mike and Ike home, and it could not all be attributed to the July midwest heat.

So we were loaded with animals and I have not mentioned them all. A constant companion was a yellow-

I read the literature avidly. These birds, in the Old World, were believed to have sustained themselves in a large part, because they were suckled by milch goats. Their wide mouth probably lead to this erroneous idea. Besides, in goat pastures, flying insects were most abundant. Ancestors of Mike and Ike found such places good hunting.

Further study of Bent's literature revealed that whippoorwills loved mosquitoes. One unfortunate dissected bird had more than 300 of these whining pests in its belly. In addition, I read, grasshoppers were highly thought of by goatsuckers whenever available. Thus I used the bug net with greater zeal, Duchess following behind me and snapping my pantlegs in the high weeds.

Whippoorwills were fed by regurgitation, the book said. Such means that mama or papa whippoorwill

catches a stomach full of flying bugs, then regurgitates, or spits, this delectable mess into the open beak of their young. Many birds do this and I have never admired them for it. I much prefer the clucking technique of a quail, and their parental persuasiveness to induce their chicks to scratch and pick up their food like a chicken. Even robins delicately convey edibles to their nests and drop tidbits into the mouths of their young. I had little enthusiasm, inclination or stomach for the proper feeding of our goatsuckers. They remained tight-lipped and adamant.

The feeding procedure for Mike and Ike required that I hold one of the birds in my hand. With thumb and forefinger of the other five digits I pulled down on what corresponds to the chin, opening the maw of the bird. Virginia,

green around the gills, would then poke in a grasshopper with a previously crushed head. She looked positively ill at times and the 'hoppers would only be acceptable head first. Otherwise, it seems, the barbs on their legs were more positive than hydraulic brakes. Mike, or Ike, would gulp, shrug his shoulders, so to speak, close his eyes and have no part of the delicious morsel.

Things in our house got no better fast. The pup wanted to play at 4 A.M. The parrot, jealous of the dachshund, shouted from his covered cage at unheard of hours of the night. Worse, the kittens were given an added ration of raw hamburger and Virginia's fingers were bitten, scarred, and covered with methiolate. The grasshopper patrol was getting most difficult. The insects were growing and I had to be selective, catching



Because of the barbs on their legs, grasshoppers had to be fed to the baby "whippoorwills" head first, a process that was not at all relished by either the author or his wife.

headed parrot of Brazilian extraction, named Eddie. Still another was a blue parakeet, with the monicker of Perky. I mention these animal assets to illustrate the reason my Virginia was not enthusiastic when I brought Mike and Ike home with me. But I hastened to tell her that I would provide for the patient little birds. I made an insect net from a rounded coathanger and sewed a mosquito head-net to it. I pursued grasshoppers with all the agility of my 58 years. Neighbors paused along the road to watch me. They departed in their respective conveyances shaking their respective heads.

The grasshoppers were not of my thinking. Immediately upon arriving home with Mike and Ike, I dived into my bird library. Arthur Cleveland Bent had done a monumental tome on the family of "Goatsuckers."



only medium-sized ones, for Mike and Ike could not take on bugs the size of English sparrows. About this time, when things were at their lowest ebb, I made the startling deduction that 'hoppers were animal protein and that raw liver and hamburger might be just as good. My birds thrived on their new diet and I threw the insect net away.

Every evening, when the sun had gone down, I took Mike and Ike on the lawn to teach them to fly. Once airborne, I reasoned, they could be self-supporting and never darken my door again. Fly they could and did. But invariably they returned to me, alighting on the short grass and waiting patiently for me to pick them up and put them back into their box.

During their early flying training, I pitched one of the birds into the air. The wind was a bit strong. Bravely he batted the breeze and at his first wing joint something gave way. He had broken the thing. I grasped the bird by the head to wring his neck and put him out of his misery. Somehow I could not do it. The wing drooped. A large blood-shot area two inches long appeared on the underwing on either side of the break. I could not tape the wing to the body. There were too many pinfeathers. I placed my birds back in their box, gave them a feed of liver, and hoped for the best.

Mike and Ike looked too much alike. The one with the bad wing I called Big Mouth. He continued to swallow his food when we poked it down him, and within two weeks was flying again. My bird book stated that my whippoorwills did not have perching feet. They could sit lengthwise with a limb, but frequently they sat on the ground. One evening I took my charges

to a large pasture with a dry lake bed and a few scattered trees. There could be no feral cats here, or high vegetation to trap them. They chirped contentedly and balanced on my hand as I pitched them up to make their flight to a new life and safety.

As if trying to please me they zoomed strongly over the dry lake. Circling, they dodged two trees, cut a circle fifty yards in diameter and then—Big Mouth alighted within three feet of me, and, of course, Mike, or was it Ike, alighted too. I repeated the performance. Like falcons trained for the hunt they flew superbly, then returned with a most satisfied look on their dour little faces. I gave up and took them home to another raw

liver feeding. This thing was beginning to get me down.

While battling sleep that night a horrible truth suddenly dawned on me. I suspect Virginia had known it for the three weeks I had worked with the little birds. Although I could not regurgitate for Mike and Ike they certainly accepted me as their mama and would stay with me forever. I had added beaten raw egg in milk to their diet, and they spoke to me whenever I walked near the cage on the sun porch.

I was trying to write a few stories and Mike and Ike were most content to sit on my typewriter, or doze in the sun while I labored. Never did an albatross loom so large or feel so heavy. Were Virginia and I to be married forever to a pair of whippoorwills? According to all bird literature they were supposed to migrate to the South within a month, and they showed no inclination



According to the literature on birds, Mike and Ike were due to migrate within a month, but they seemed content to sit on the typewriter, or doze in the heat of the sun.

to leave. Apparently they had never read the books.

One evening in desperation I again broke out my bird books and turned to the goatsuckers. Unfortunately, in the past, I had not read far enough. There were several kinds of these suspected milk-drinkers, the chuck-will's-widow, the poorwills and the nighthawks. I pulled Big Mouth from his box and spread his wings studying the primary feathers and the coloration. My birds were not whippoorwills, they were nighthawks! They ate mosquitoes and grasshoppers like their cousins. Then I read about their nesting sites. They like light, gravelly soil, the book said, but because of lack of good habitat, they were now commonly found nesting on

gravel rooftops, even in metropolitan areas. Making no nest whatever, mama nighthawk was prone to squat in the tar-embedded gravel and hatch a pair of eggs.

For the first time in seven years I was in a hurry to get to my office. I consulted Bud Skinner, our custodian. "Sure," he said. Our two-story office building had a gravel roof. It occupied a square block. Behind this edifice were woodland and low clay bluffs. Bud took me on top directly over my own office. He showed me an expanse of gravel and tar as big as the Yankee Stadium. Two workmen were adjusting the air-conditioner. It was housed in a square penthouse affair and from it ran a two-inch black pipe.

"Did you ever see a bird nesting here?" I asked them. "She should have had young ones—two of them."

The workmen beamed. "Yes," said one. "Right there beside that black gaspipe. We saw a bird one day, thought she was a cripple. But she had two eggs and hatched them out right there in that hot gravel. Funny, too, the two little birds ran all over the roof. About three weeks ago they disappeared. Guess they fell off the building and a cat got 'em in the alley."

When I told Virginia of my discovery she said nothing. Had I the brains of a biologist I might have known that Mike and Ike came from a gravel roof. They could have been returned to their parents. Sundown found me putting them in a basket to return them to their birthplace. My wife kissed both the solemn-faced little birds on the beak when I took them away. "I will say a prayer" she said, "that you two find your mama."

Had my neighbors, critical of my grasshopper-catching, seen me at twilight on top the two-story building, I might still be in an institution. I had Mike and Ike in the little basket in which the Duchess had been shipped. Carefully I walked the duckboards across the wide expanse of gravel roof. I sat down near the black gaspipe where my birds had been hatched. I craned my neck, watching into the sky, hoping for the mother nighthawk to appear. This would have been the perfect ending to the Saga of Mike and Ike.

Darkness enveloped the little birds and me. Fifty yards distant, automobiles swished down the four-laned highway. Neon lights illuminated a second-hand car lot. From within the basket came contented chirps from Mike and Ike. No doubt they realized their foster grasshopper-catching parent was with them. I was. Still looking skyward, I prayed that a mother nighthawk would show up to claim her young.

Blue-black night deepened. Another five minutes and

I would take my birds home with me again. I hated to turn them loose on my place. Cats and heavy shrubbery were not the environment for little birds that roosted on the ground. Suddenly, below us, the air conditioner started. Whether the sound was familiar, because the nighthawks had been born next to it, or because some Great Unseen Guiding Hand said, "Now is the time," the birds cooed loudly, making a sound I had never heard before. At home, I would always need to take them from their box, sit them on my hand and toss them into the air, to make them fly.

The little basket of the Duchess had no clasps on the lid. Suddenly one of my nighthawks jumped upward. He dashed the top aside, flew around the penthouse-like air-conditioner, and headed towards the clay bluff, as strong a-wing as any adult bird. Automatically, I reached to close the basket as bird number two took wing equally as enthusiastic, flying strongly, overhauling his brother or sister.

Slowly I arose from the duckboards across the wide expanse of gravel and tar. Unconsciously I had the little basket under my arm. Probably I looked ridiculous but only God saw me. Tears were in my eyes. Before and beneath me mad traffic streamed, sending the stench of exhaust up to the lonely roof. Behind were clay bluffs and woodlands where I hoped Mike and Ike might find safety.

I drove slowly, back ten miles to my farm. Had I witnessed a miracle? Had the Man Upstairs hearkened to my prayers for the welfare of Mike and Ike? My prayers could not be very potent for I have never been reputed to be a devout man.

Virginia met me at the door. Silently I showed her the empty basket. Duchess, by the way, snapped at my flapping pantlegs and growled ferociously through her puppy teeth. My better half of a quarter-century asked no questions. Almost tenderly she took the basket—to put it away where I would never see it again and think of Mike and Ike.

"I knew God would take care of them," she said simply. "You worked so hard, I knew He would."

Somehow, I feel we answered a challenge. Love, grasshoppers, liver, milk, and raw hamburger saved Mike and Ike, made them airborne to decrease the population of mosquitoes and noxious insects and make the world a better place for us to live in. Also, through worrying over our little charges, Virginia and I were brought closer together. People married twenty-six years often take too much for granted.



## LITTLE PATH

*A little path runs through a wood,  
And never goes just where it should.  
It darts one way, meets a blackberry bush;  
A tree is next in the line of its push.  
The low tree bows enchantingly  
But the little path doesn't wait to see.*

Gertrude Pleasants

# The Fall of Sheep Mountain

By ROBERT B. McCOY

*Photographs by United States Forest Service*

LIKE SOME flat and verdant saucer, Wyoming's beautiful Jackson Hole lies in the midst of a jumble of spectacular, snow-capped peaks. To the west soar the ramparts of the Grand Teton mountains; to the east, the colorful and serrated escarpments of the Wind River range. To the north these mountains merge in an up-sweeping march of mighty forests. To the south rear the bare, colossal Gros Ventre mountains, so named because they adjoined the lands of a tribe of Indians the early French explorers called the Gros Ventres, or "big bellies."

Many streams rise in the frigid, stormy heights of all these mountains, and one of them is the Gros Ventre. Its source is in the heart of that range, and it courses in a raging torrent through twenty miles of wild forest and roaring canyon. For countless centuries, this crystal stream had worked from east to southwest to cut a huge mountain half in two, and when old Dave Jackson settled the land in 1827, he called the naked half that faced the valley Sheep Mountain. He said it looked like a sheep.

People came to this gracious land, and found nourishment and sustenance at the feet and on the slopes of the mountain. Their cattle roamed belly-deep in rich, tilted meadows below the heights. After the civil war, a pioneer named Jim Kelly founded a village in Jackson Hole only six miles down the Gros Ventre River from Sheep Mountain. And from the moment the first tree was cut to build it, this village and many of its people yet unborn were as doomed as was the high and mighty mountain.

In 1925, spring had come late to Jackson Hole and the mountains around it. A rancher named Guil Huff had a handsome spread of 2500 shorthorns, and while his ranch was downriver close to Kelly, his stock usually grazed on the green lower pastures of Sheep Mountain.



This photograph of the Gros Ventre slide was taken in 1937, ten years after the dam broke and twelve years after the slide. Notice filled Gros Ventre canyon running to the right; the slide was two miles wide and a half-mile high. Photograph encompasses an area of some 35 square miles.

For the first time that spring, Nature was shining, on the twenty-third day of June. The sky was bluer than the purest lapis; the clouds crowding out of the mountain canyons were no longer laden with gray rain, but were burnished whiter than the heart of a milkweed pod. Yellow dandelions, buttercups and poppies made a spangled pattern in the rolling green carpet of the Jackson Hole country. The breeze, as it poured down the mountains and through the forest, was crisp and heady with the fragrance of washed pine and the nameless odor of the fast-warming earth.

On such a morning, Guil Huff rode across the river and into the shadow of Sheep Mountain to see how his steers had survived the weeks of drenching rain. A stern, hard-working man, Guil seldom paid attention to the natural beauty about him, but on this day the freshness of the sky and the brilliance of the distant miles led him to stop on a small rise and look about him.

Below and before the rancher lay the wide, green valley, and in the distance he could see the blue smoke that betokened the chimneys of Kelly. To his left, the Gros Ventre river boiled to the lips of its channel, turbulent now with brown soil and heavy with flood debris. Beyond the river rose the worn north half of the mountain the stream had divided. To his right lifted the seemingly solid, tree-clumped side of Sheep Mountain. The slopes to the summit above him were dim in a shroud of misty, low-riding shreds of cloud. At the mountain's broad feet, the tilted green meadows were spotted with the brown humps that were Guil Huff's steers. There was no warning that all this was

This picture, also taken in 1937, shows what is left of the lake that was impounded by the Gros Ventre slide 12 years before; it is nearly filled with silt now, and retains only a small amount of water.

about to be blotted out in swift disaster.

In that moment, only two hours after dawn had lighted the sky for another day, Sheep Mountain died in travail. Guil Huff's horse reared in sudden fright as the earth beneath him began to tremble. The rancher fell, but scrambled to his feet and remounted the horse in alarm. Boulders began to rock, and then to tumble down the slope toward the doomed cattle. For a moment, Guil thought to drive them into a stampede out of danger, but it was too late.

The whole side of the mountain was beginning now to shudder and move. Rocks and boulders were rolling downward with shocking crashes, and trees began slowly to tip their tops toward the horizon. An anguished sound came from within the earth, growing louder until everywhere about was the groan of unspeakable exertion.

Guil Huff rode his horse away from the slide, upstream, and began a furious gallop across the weaving footing to safety. Horse and rider churned across the Gros Ventre in a shower of muddy water, and scrambled up the bank on the other side.

Now all Nature was screaming in agony. Crevasses yawned with great, sucking gasps and then filled again with muted thunder. The biggest trees were smashed to splinters in an overwhelming cascade of uncounted millions of tons of earth and rock. The ground heaved in spasms; the sound of Nature tortured beyond endurance mounted to a roaring crescendo.

With the climax came a sudden cessation of all sound, and it was finished. The doing and undoing of countless ages was now complete, and Sheep Mountain was dead. So were the steers of Guil Huff, and those of his neighbors, and all the four-footed wildlife that had known the north face of the great mountain. Gone were the spiring trees, and the silvery trout in the vanished stream. Gone, even, was the green canyon of the Gros Ventre, for now it was filled. The vast, majestic heap of rubble once again joined together the halves which the crystal stream had so patiently severed through bygone millenia.

On the north side of the Gros Ventre, Guil Huff reached higher ground safely, but shaken. Shortly he was joined by Tyler Gordon, Red Stevens and Jim Dugger, each mounted on a frantic, winded, foam-flecked horse. Like Guil, they had lost in the slide practically all their cattle, and their animal shelters and corrals as well.

As they sat their horses, looking in stunned disbelief at the wreckage before them, they became gradually aware of something else. Swirling in an angry boil of water, the dammed stream was throwing a mounting



fury at the rubble now barring forever its ancient course to the valley.

The ranchers forced the weary horses into another climb, sometimes leading them. Below, with inexorable swiftness, the dammed waters rose eagerly to trap the men and their animals. It was a grim, half-hour fight up the abrupt side of the canyon, but the men and two of the horses escaped; the other two broke their great hearts in the frantic climb. About noon, Huff and Dugger reached Kelly with the news, but by this time the fifty-six citizens of the town and vicinity were already aware that something had occurred upstream to stop the flooded flow of the Gros Ventre River.

The afternoon and twilight of that day was a nightmare of fear, doubt and indecision by the people of Kelly. Should they stay, or leave? Everyone able to ride or walk went upstream to see the slide. In the light of the afternoon sun, the awestruck visitors saw a raw, gaping tear on the mountain's whole north face. Nearly half the peak, for a distance of two miles east and west and half a mile up, had fallen into the Gros Ventre canyon. A million tons of earth and stone had moved a mile, and the shift of such a mass changed the face of the earth in the Jackson Hole country.

Citizens of Kelly lived in dread in the days that followed the fall of Sheep Mountain. A lake formed behind the new dam; a body of water 280 feet deep at the dam stretched seven miles back into the canyon fastnesses of the dead mountain, and this impounded flood offered a fearful threat to the people of the valley. Engineers and experts on dams came from far and near, as did sightseers and the curious. The professional men measured and surveyed, measured and surveyed, then said the dam would never break. The village and valley people need fear no more, said the Men Who Ought To Know. Ordinary citizens, looking at the incredible mass that composed the dam, could simply not conceive of it ever giving way.

So, with the passing of days, (continued on page 332)



# Dragonflies

*Jets of the  
insect world*

By ROBERT M. McCLUNG



*Illustrations by the Author*

**S**NAKE feeder, snake doctor, bee butcher, horse stinger, mosquito hawk, devil's darning needle, dragonfly. . . The insects that are known by so many fearsome names are also saddled with undeservedly bad reputations. For centuries dragonflies have been the victims of countless wild tales and superstitions that have turned people against them. These inoffensive insects are said to sew up the ears of disobedient children, or sting them without warning. They are reputed to feed on dead snakes, and to bring dead snakes back to life by some mysterious magic.

The truth is that dragonflies are perfectly harmless, and, as a matter of fact, are beneficial to man. They have no needle or stinger, and their bite is reserved for the insects that they catch for food. Since they feed primarily upon mosquitoes and flies—insects that are definitely harmful to man—dragonflies are really allies in man's never-ceasing warfare against the injurious insects.

Dragonflies are beautiful things, too, with bodies that are models of streamlined symmetry and colors that are glittering and metallic. Their flashing movements are almost unbelievably swift and skillful. Now up, now down, now zigzagging back and forth, a dragonfly darts through the air almost faster than the human eye can follow. Suddenly it stops and hovers motionless, its rustling wings gleaming in the sunlight. Outside of the insect world, the only creatures that can rival such dazzling aerial performances are the hummingbirds. These two groups of animals easily perform all sorts of complicated flight maneuvers that man, in his most advanced aircraft, has been unable to approach.

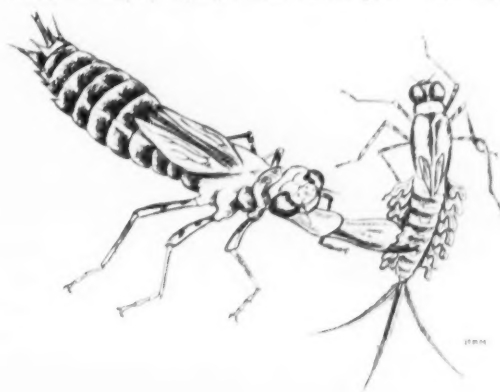
Dragonflies, together with their near relatives, the damselflies, make up the

great insect order called the Odonata, which includes more than 5000 recognized species. Damselflies can be distinguished from their larger cousins by their more hesitant flight, and by the way in which they hold their wings closed over their backs when they are resting. Dragonflies always rest with their wings open and flat. As a group, however, the Odonata have rested little, for they have been coursing up and down the various waterways of the world for some two hundred million years. Even before they appeared, their now extinct ancestors, the lordly Protodonata, flew above the primeval marshes on wings that sometimes spanned two and one-half feet.

Today, the largest of the 650 or so species of dragonflies found in the United States have a wingspread of no more than four or five inches. One of the biggest and commonest of them all is the one known to entomologists as *Anax junius*, but to people in general as the darning needle, or green darner. It is a cosmopolitan species, likely to be found wherever there is fresh water, from Alaska to Central America, as well as in parts of eastern Asia and some of the Pacific Islands.

Green darner, coursing back and forth across the summer pond, is a striking creature, with a grass-green thorax and an abdomen that is bright blue with black

A full-grown dragonfly nymph, two inches long, seizes a mayfly nymph with its hinged lower lip.



markings. He zooms high in the air in his search for food, and the next moment swoops low over the water. Then he hovers motionless, his wings fluttering up and down so fast—as many as twenty or thirty beats a second—that their movement is a blur.

Green darner's four narrow wings are marvels of engineering construction, carrying the biplane principle to its peak of perfection. Each transparent flying surface is tissue-paper



A newly-hatched green darner nymph, with empty egg-shell and egg about to hatch.

thin, and is stiffened by an elaborate network of veins that act as struts or strengtheners. The leading edge of each wing is creased, giving additional strength needed for high speeds.

Dragonflies have been clocked at fifty to sixty miles per hour, but green darner can possibly fly at even greater speeds for short spurts. Dragonflies are not the swiftest insects, however, for speeds of several hundred miles an hour have been claimed for the deer-botfly. But dragonflies are second to none among the large predatory insects that depend on speed and maneuverability in securing their food. They are so swift that they are seldom caught by birds or predatory animals, but are most frequently killed by the great impersonal enemies—rainstorms, high winds, or the plunging temperatures of autumn.

In sharp contrast to most insects, whose fore and hind wings move in synchronization, dragonflies flutter their front and hind wings in opposition during flight. Their front wings are on the upstroke while the hind wings are on the downstroke, and vice versa. This specialized method of wing movement undoubtedly helps to maintain control and balance at high speeds, just as the opposing propellers on a two-engine plane cancel out torque or twist action.

A skilled hunter, green darner searches for food as long as daylight remains, and few insects are able to

escape his swift pursuit. Enormous compound eyes, each consisting of many thousands of separate six-sided units, cover most of his head. Green darner can spot motionless objects as far away as six feet, and moving objects at two or three times that distance. Compared to most insects, dragonflies have remarkable vision.

As he flies through the air, green darner holds his six spiny legs in a sort of loose basket below his body. Ahead of him he sees a mosquito flying slowly above the water. Quick as a flash, he pounces down and scoops it up in the basket. Grasping his victim firmly, he eats it on the wing. His tooth-edged mouthparts are strong and horny, ideal for cutting up and chewing his prey.

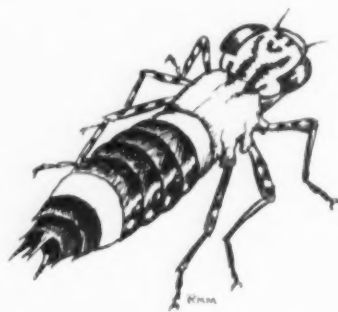
When dusk comes, green darner lights on a leafy shrub by the water's edge and rests there throughout the night, sheltered by the leaves around him. The next morning, as soon as the sunshine has warmed the day, he is off again—across the fields, high above the trees, hunting for food wherever he goes. Finally, he returns to the pond and cruises back and forth, patrolling a regular beat or territory. Others of his kind are at the pond, too, the great majority of them males winging back and forth on patrol. They seem to be tireless creatures, seldom resting on the cattails as the smaller dragonflies do.

Another male flies close to him, and green darner pursues him and chases him away. The reproductive instinct is strong within him, and he tolerates no competition around him. He prepares for mating by looping his abdomen downward and forward and transferring sperm from the ducts in the end of his body to storage sacs on the under side of his abdomen, just behind his legs.

A female, more greenish in color, flashes across the pond, and green darner sets off in ardent pursuit of her. When he catches up with her he grasps his mate around the neck, holding tight with two claspers at the tip end of his body! Linked in tandem fashion, with the female behind, the two insects fly across the pond. The female fertilizes her eggs by bending her abdomen around so that its tip is in contact with the male's sperm storage sacs. Green darner remains joined with her while she begins to lay her eggs.

Lighting on a cattail stem, the female thrusts her abdomen under water. Piercing the plant tissue with her ovipositor, the sharp, egg-laying organ at the end of her body, she inserts a pale green—almost white—egg into the stem. The egg is long and oval, shaped like a tiny watermelon, and is about one twenty-fifth of an inch long, barely big enough to be seen with the naked eye. She lays several more eggs in the same stem before flying on to another cattail, for she has more than a hundred eggs to lay.

As the days go by, hot and sunny, the tiny life within the egg develops quickly in the warm waters of the



The nymph, after several molts, is now about one-half inch long.

pond. Soon the eyes of the infant dragonfly can be seen through the shell. Six days after the egg is laid, a tiny wingless creature no bigger than a flea hatches from it. From the moment the dragonfly nymph emerges, it is on its own, and is admirably equipped for its aquatic existence. Agile and alert, it crawls through the underwater vegetation, pouncing on and devouring microscopic pond animals that are even smaller than itself. It is a striking looking little insect, with a prominent white cross on its head and a white spot on its abdomen. It eats and grows, and after a few days its outgrown skin splits down the back and the nymph wriggles out, clad in a new skin that has developed underneath the old one. Before it becomes an adult, it will shed its skin twelve or thirteen times.

With each successive shedding the nymph's appearance changes. For a few weeks it is banded white and brown, but by the end of the summer it is an all-over dull greenish color. By this time it is close to an inch long. Small



The dragonfly is now free of its case, wings full-grown.

wing pads or flaps have developed on its thorax—the beginning of those intricate structures that will eventually carry it swiftly through the air as an adult.

The frosts of fall kill the adult dragonflies around the pond, but the hardy nymph clings to the dead leaves under the ice and survives. He does not eat much during the winter, for suitable food is hard to find. Most of

the more delicate insects and other invertebrates that were so abundant in the pond during warm weather have died, leaving only their eggs to hatch the next spring. Many other pond animals are hibernating, hidden in the mud or under rocks.

Finally the spring sun sparkles down, warm and friendly. The ice melts slowly away and plants begin to grow again. Frogs, turtles, and salamanders reappear in the pond after their long winter sleep, and the water teems with new life as insect eggs hatch out. Once again the green darner nymph has plenty of food. He eats voraciously throughout the spring months and grows much larger. By July, when he is a year old, he is almost two inches long.

A cunning beast of prey, he waits, silent and watchful, clinging to a waterweed head down, ready for anything that may blunder close enough for him to seize. A half-inch-long tadpole swims nearby, and the nymph turns its head to watch as the

Adult insect bursts its nymphal shell, its head and thorax free.

unsuspecting victim comes closer. But the tadpole turns away, and the nymph stalks it, slowly, deliberately. Then, with a lightning-quick lunge, green darner nymph flashes forward and seizes the tadpole with its extended lower lip. It drags the struggling victim back to its waiting jaws, and in a few minutes devours it.



The nymph's lower lip, armed at its tip with sharp hooks, is a truly remarkable mechanism for seizing and holding prey. Double-hinged, it folds back under the nymph's head and between its legs when not in use, but it can be shot forward almost a third of the nymph's body length. With this efficient weapon the nymph can grasp and hold victims almost as big as itself, sometimes catching fish that are an inch and a half long.

Green darner's abdomen expands and contracts as he eats his meal, for he breathes by pumping water in and out of the opening at the posterior end of his body. Oxygen from the water is absorbed into the gills that line the body cavity, and is then circulated by means of air tubes. When a big pond turtle swims toward him, the nymph shoots forward through the water and escapes by squeezing all the water out of his gill chamber. The force of the backward-shooting water moves him swiftly forward by jet propulsion.

By the end of July the nymph is full grown. For several days he remains quiet in one place without eating. Great changes are going on within his body to prepare him for the big transformation to come. Then one night he crawls out of the water, scrambling rapidly up a cat-tail stem. Finding a spot that seems to suit him, he hangs there for some minutes, motionless and damp. A hungry bird, turtle, or bullfrog could catch him now with little difficulty, for he is out of his aquatic element, and not yet ready for an aerial existence.



*Anax junius* pair in tandem; the female is behind male, whose claspers are around her neck.

At last the nymphal skin starts to split down the back for the last time. A green thorax humps its way through the opening, and then a head with two great glistening eyes appears. Slender spiny legs are pulled out of the sheaths of the old skin. An adult dragonfly hangs back to rest, its abdomen still imprisoned in the nymphal shell.

Finally green darner renews its struggles. Jerking its body violently upward, it grasps the old nymphal skin with its legs and pulls its abdomen free. It is a limp, wet, and helpless creature with a flabby, elongate body, and wings that are tiny and crumpled. (continued on page 330)



The imported fire ant is causing yearly losses of hundreds of thousands of dollars to such southern crops as cabbage, corn, broccoli and collards. Here a group of imported fire ants is eagerly attacking the unopened bud of an okra plant.

If you live in the deep South, you probably know better than to sit on an old stump, or take a nap in the grass, or even to spread a picnic lunch on the ground. The domestic fire ant, *Solenopsis geminata*, can sting like a hot needle, and the after-effects are likely to be etched so indelibly on the memory that you will not want to repeat the experience.

Now comes a visiting hymenopteran cousin, com-

*Battle-lines are forming to oppose*

## An Unwelcome Immigrant

By E. JOHN LONG

*Photographs by United States Department of Agriculture*

monly known as the imported fire ant, with the rather formidable scientific name of *Solenopsis saevissima* *r. richteri* Forel. This tiny saboteur also has a painful sting, plus a ravenous appetite for vegetables, fruit, germinating seed and citrus trees. It attacks newly hatched birds, being particularly fond of quail, and in homes it eats meat, butter, cheese and nuts, and sometimes gnaws holes through clothing. Farmers have difficulty recruiting help where fields are heavily infested with the strong-jawed little demons.

Despite vigilant plant quarantines and careful watch at ports for all kinds of insect predators, the imported fire ant somehow slipped into the country from South America unnoticed, probably as a cargo stowaway, or perhaps in a traveller's luggage, in the early 1920's.

Because they look somewhat like native fire ants, the foreign invaders remained undetected for several years. Scientists know this to be true because, by the time they had been identified as a separate species, about 1930, they had spread over a considerable part of the South bordering the Gulf of Mexico.

The suspected port of entry is Mobile, Alabama. Infestations are heaviest in this area, and have spread out fanwise to the west, north and east for about equal distances. In addition to flying and crawling, the imported fire ant has shown that he is a very accomplished hitch-hiker. He drifts on logs, travels aboard automobiles, trucks, trains and even airplanes, and readily survives shipment in nursery stock.

As a result you will find thriving colonies scattered over ten southern States, as far west as Texas, east to Georgia and Florida, and north to within fifty miles of the southern border of Virginia. Worst of all, scientists observe in southern Alabama that the imported fire ant is now more prolific than any of the native species, and where it moves in, the other ants become scarce.

What is the secret of the alarming vitality of this



Thriving colonies of the imported fire ant are found in ten southern States, spreading fan-wise from the original port of entry, believed to have been Mobile, Alabama.

little alien, and how did it establish so broad a beachhead in such a comparatively short time? In the first place, the imported fire ant has not had to reckon yet with "Nature's balance;" that is, as yet unknown enemies that normally keep it in check in its native Argentina, Brazil and Uruguay. In the second place, it develops a remarkably efficient type of colony, after the manner of other ants, but on a larger, more dramatic scale.

There are three adult forms: winged females or queens, which lay the eggs, winged males that mate with the queens; and worker ants, which are wingless females and usually sterile. First the queen digs an underground chamber and starts laying her eggs in clusters that resemble finely ground meal. The larvae that hatch are dirty white grubs, depending upon the queen and the workers for food. Larvae become pupae, resembling adult ants in shape, and, if they are to be workers, remain wingless.

Soon the workers begin to build a cone-shaped earth mound—another of the reasons why the imported fire ant is an unwelcome guest. The mound is a necessary living annex, because an average-sized colony may consist of as many as 25,000 workers and only a few dozen winged forms. The latter live in regal seclusion underground, until the time comes for them to take off on their one and only mating flight.

Something akin to the excitement of coronation-time in England pervades the ant colony when the mating flight is about to occur. There is much feverish activity around the mound, with workers dashing around, and opening new holes in the mound surface here and there. Every now and then a male or a queen will come to one of the openings and peer out, perhaps to check flying conditions, or maybe just to



watch the workers running about like frenzied promoters.

Finally comes the big moment. The males take off quickly and directly from the sides of the mound. The queens usually climb on nearby plants, and, like little overloaded planes, slowly lift their bodies into the air. Mating is done in flight, and the males die soon afterward. A short distance away, unless they are caught in a sudden unexpected wind, the queens land and dig underground, casting off their wings and preparing the chambers in which they will lay more eggs.

What prompts the colony's leaders to seek a new home?

Need for more food, perhaps, or a disturbance of the mound. Sometimes the mounds become too big and unmanageable. And what becomes of the workers left behind? First they locate the new nest, which usually is not more than 25 feet away. Then they carefully carry the unhatched eggs and immature insects of the old colony to the new location.

The mound itself is a remarkable structure for small creatures of only one-eighth to one-quarter of an inch in length. Built of almost any kind of



The illustration shows the size of the mounds built by the imported fire ant. Mounds are most common in open areas like cultivated fields, pastures, parks, lawns and meadows.

soil, mounds may rise in cultivated fields, pastures, golf courses, and even on lawns or under porches. Worker ants quickly erect it when the queen's first brood begins enlarging her underground chamber. As more workers arrive, the mound must be made higher. It appears solid, but a mound is really a honeycombed framework whose passageways are revealed after every heavy rain. It may range in height from ten inches to two feet or more.

To man, the mound serves one useful purpose—it reveals the location of an ant colony. But it is most unsightly, and, in grain fields, the blades of harvesting machines are often twisted by colliding with it. Mounds arouse the curiosity of children and pets, who may be severely stung when they walk into them, or otherwise disturb them. Workers or stinging ants rush from tunnels in the ground surface some distance from the mounds, and converge like an avenging army on the molesters.

In Dallas County, Alabama, where an intensive study of the imported fire ant was conducted in 1952, it was estimated that the loss on improved pasture land, including damage to machinery, was \$40,000. Counts of from fifty to seventy-five mounds an acre are common in some parishes of southern Louisiana. Crop losses of cabbage, broccoli, okra, corn, egg plant, and collard run into hundreds of thousands of dollars.

Lacking a natural enemy, what can be done to counter-attack the imported fire ant? Three methods of control—mound treatment, area treatment, and building and lawn treatment—have been worked out by the Agricultural Research Service of the United States Department of Agriculture. All involve the use of highly poisonous insecticides, requiring some experience in handling.

Those interested in preparing and using such sprays and powders should write for Leaflet Number 350, "The Imported Fire Ant, How to Control It," from the Superintendent of Documents, United States Govern-

ment Printing Office, Washington 25, D. C. The price is five cents, postpaid.

Perhaps those who live or who visit in the South may be more immediately interested in self-treatment, in the event that a fire ant injects his stingers. Because the fluid that causes the irritation is formic acid, doctors say they have no better remedy than old-fashioned baking soda, daubed on—plus patience and perhaps a mantle-piece from which to eat one's meals, if necessary!

At hearings held by a House Agricultural subcommittee in March, 1957, the need for more funds to fight such menaces and nuisances was declared imperative. W. L. Popham, assistant administrator in charge of Agriculture's plant pest control program, predicted that at the rate they have been spreading, fire ants may possibly invade Virginia and the District of Columbia during 1957.

Other Department of Agriculture specialists, who began spending money in 1950 to fight the intruders, report that counter-measures through State and county agencies have not been able to stem the tide. They recommend that Congress provide funds to send out "exterminator teams" to work in the field in a sort of "pattern bombing" (from the ground, of course) of infested areas.

Congressman T. Ashton Thompson (D-La.), appearing before the subcommittee, predicted that unless prompt steps were taken to eradicate the menace, imported fire ants will spread "so fast they'll soon be in every State in the Union. It would be ironical if we spent billions to fight communism, only to be eaten up by ants!"

Editor's Note: A bill to permit the Department of Agriculture to intensify its drive against the imported fire ant and other foreign insect pests, introduced by Congressman Thomas G. Abernethy (D-Miss.), was passed by the House and, with a Senate bill, was in conference at press time.



## BENEATH MY TREE

*I looked directly up to see  
A squirrel looking down at me.  
Incredulous he was to find  
A creature not of his own kind.  
His eyes grew bigger, beadier,  
His tilted glance grew greedier  
To gather in this sudden knowledge  
He never learned in squirrel college.  
In looking through me what he saw  
Was nothing based on human law;  
Did he see tensions strange to him  
And psychic moods to me quite dim?  
I know he never thought of me  
As owning what is his own tree.*

Louise Mayers Meredith

*Along the edge of  
an abandoned upland  
field you are likely  
to meet*

## The Indigo Bunting and His Family

By GEORGE A. SMITH

The indigo bunting is probably more common than generally realized, because at a distance, and against certain backgrounds, the male looks black; the female indigo bunting is often mistaken for a sparrow.



*Photographs by the Author*



A NUMBER OF members of the bird family that includes the buntings, the grosbeaks and the finches furnish our woods and fields with flashes of color that sometimes, against sharply contrasting backgrounds, seem to border on the unreal. One of these is the male indigo bunting, bedecked in a solid tunic of rich blue feathers during the mid-summer days, perhaps doing sentry duty from a nearby perch in the high branch of a tree, while Mrs. Bunting is caring for their young.

The female has but a tinge of blue in her feathers, and closely resembles a little brown sparrow, while the young of this violently contrasting pair, whether male or female, will have the coloration of the mother until they are nearly full-grown. It is not until after the first molt that the male youngsters begin to take on the deep blue color of their father.

The female indigo bunting likes to build her nest in neglected upland fields along the edge of some wooded area. She builds well out of sight, in the thick branches of a low-growing tree, or in the friendly shelter of a tangle of bushes. 🌳 🌳 🌳

In a nest substantially constructed from grass and animal hairs, the female indigo bunting lays from three to four pale bluish-white eggs.



Three small but ravenous indigo buntings make a full day's work for the female. Young birds do not eat much at any one time, but their rapid digestion makes a steady food supply imperative.

Mother bunting arrives with a beakful of insects, and Junior's mouth opens wide with expectation.

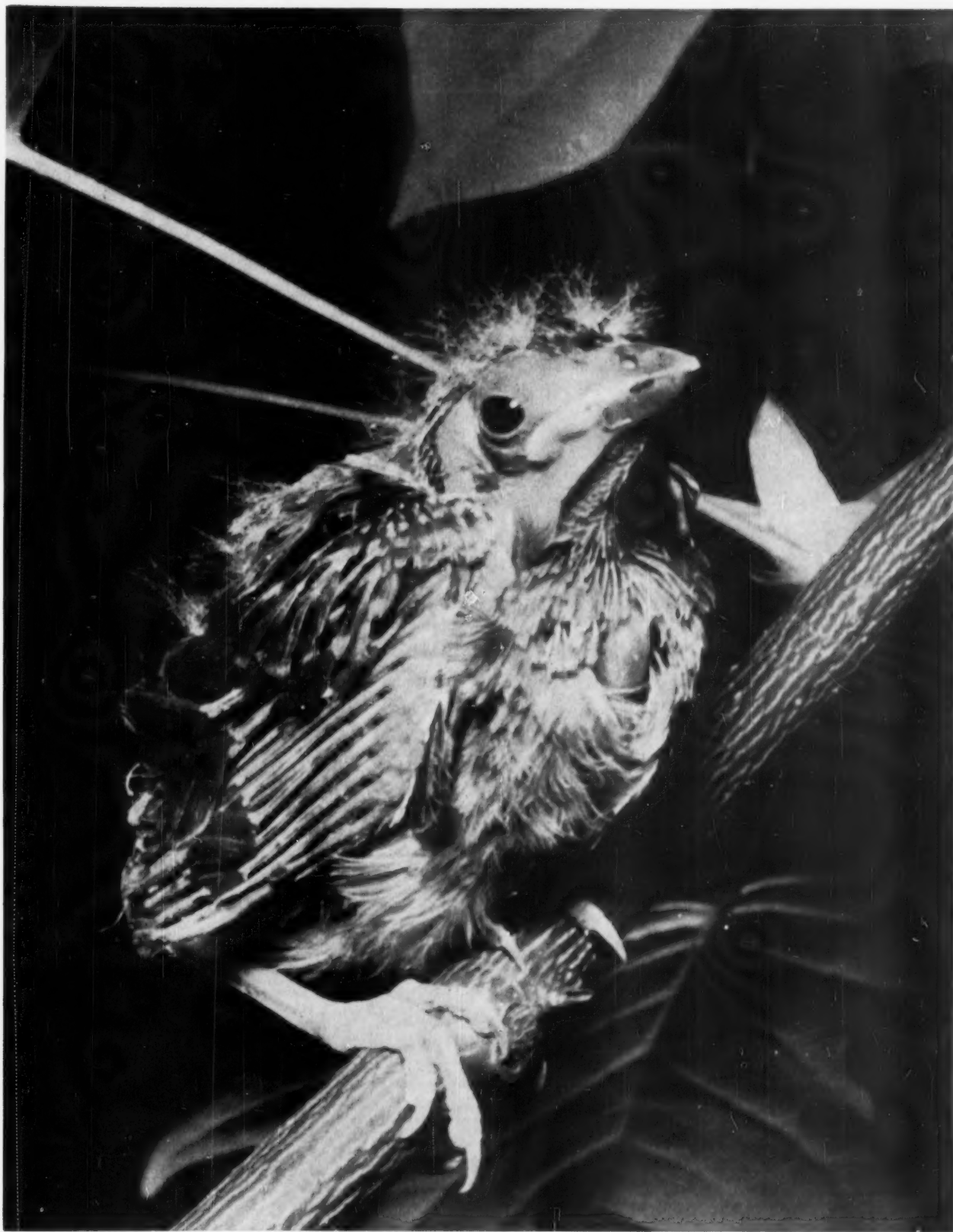


In they go! The feeding process is somewhat reminiscent of stoking up an old-fashioned coal-burning furnace.

Mrs. Bunting makes sure that the load of insects is well settled in the bottomless cavern.







Satisfied, at least for the time being, the youngster settles back comfortably on a branch while his mother goes in search of insects for the two other fledglings—a search that may, in the case of the indigo bunting, cover an area of approximately five acres.

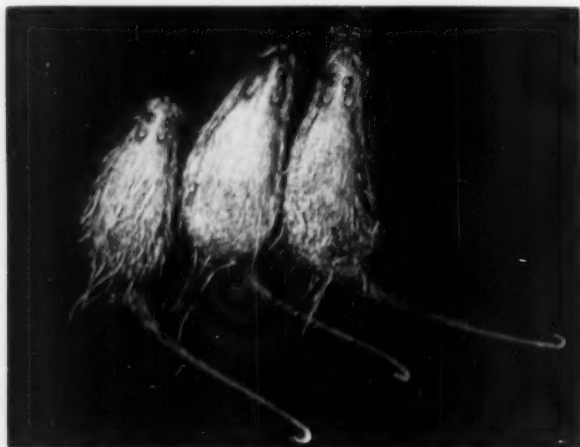


Male (left) and female *Ricinus* beetles, var. *chromus*. Few of the species found by Dr. Bhugnatz were handsomely colored, but *Ricinus* was purple and green, with cream-colored legs.

## New "Insect" Discoveries

*As photographically  
recorded for Dr. Adolph  
C. Bhugnatz, Ph. X., by*

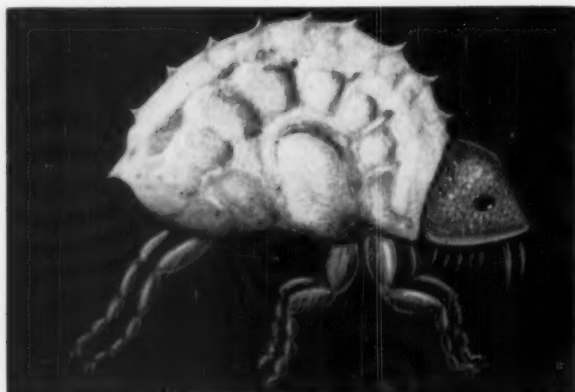
WILLIAM D. BARKLEY



The hook-tail mouse, *Geomys hookus tailus*, was considered a rather remarkable specimen of mammalian life by Dr. Bhugnatz, although not of technical interest to the entomologist.

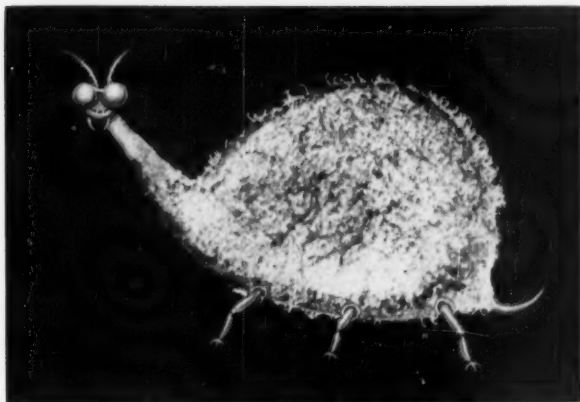
If you have never heard of Dr. Adolph C. Bhugnatz, intrepid entomologist, do not let it worry you. The bug-hunting Doc has spent the greater part of his adulthood combing the world's jungles for new insects, after passing through the larval stage at the University of Tillamooch, where he was regarded by his professors as being a rather remarkable specimen himself, and a scientific worker of great promise.

Quite recently, Dr. Bhugnatz returned from a jungle trip, with a two years' growth of beard and a collection of most unusual insects and mammals. (There is no connection between the beard and the insects; but according to *Nature Magazine's* notion of professors emerging from jungles, Dr. Bhugnatz must certainly be credited with a beard.) The Doctor is aware that the results of original research are often challenged by skeptics, and he has therefore enlisted the assistance of a Baltimore artist and photographer, William D. Barkley, through whose skill the Doctor's discoveries are here recorded. 🐞

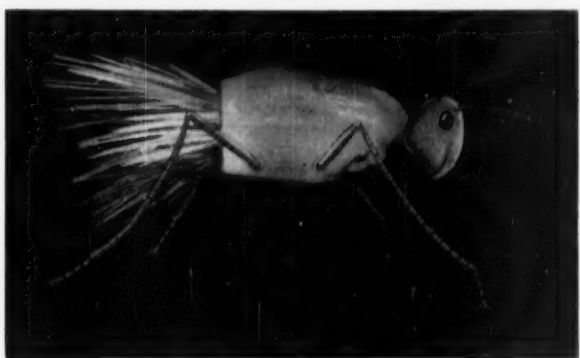


*Oceanus spinus*, the spiny sea-bug, spends most of its time in the shallow waters of streams, feeding on grains of sand, from which it derives the silica of its granite-hard shell.

← At left is the nutmeg beetle, *Nutmegus beetleus*, with jaw muscles that can cut a nutmeg in half in a matter of minutes. Size range, three to five inches.



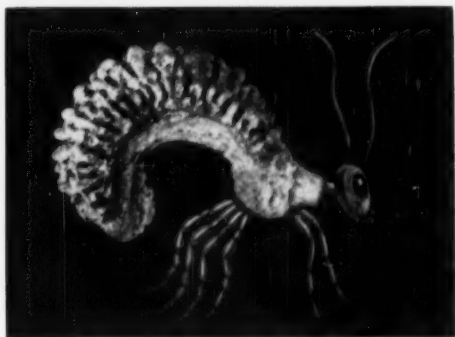
Evolutionary changes have treated the dinosaur bug, *Dinosaaurus minaturius*, rather shabbily; the little fellow seems to have become smaller, instead of larger.



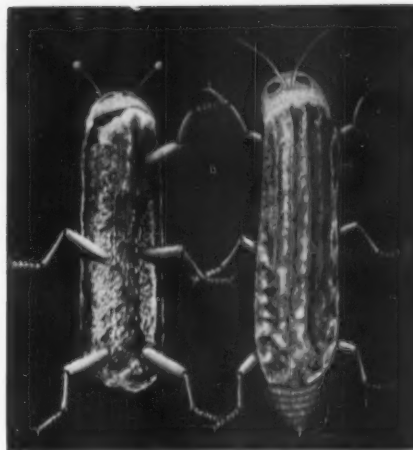
New to the entomological world is the brush-tailed warrior beetle, *Centaurea battileus*, with a sheaf of barbed, poison-tipped spikes it can aim and shoot.



One of the unusual features of the twist-tail wheat-hopper, *Triticum twistus*, is the unwinding and rewinding of its tail, according to fluctuations in humidity.

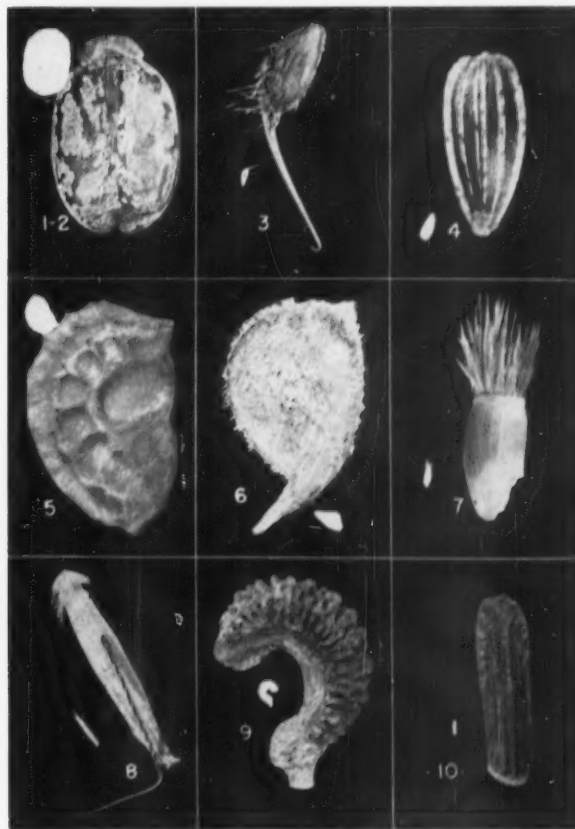


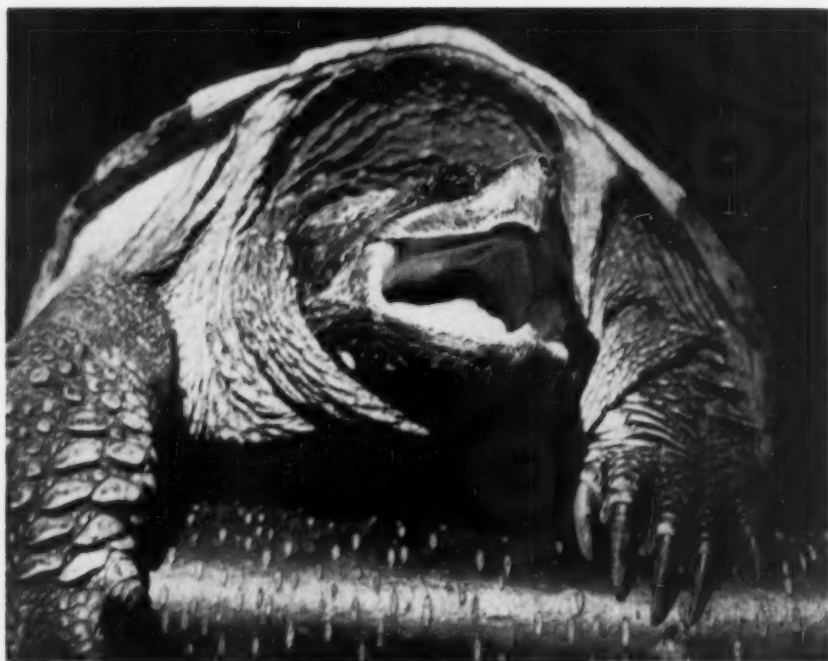
This insect is known to jungle-dwellers as the calendula road-runner, and to Dr. Bhugnatz as *Calendula runii*, extremely fast in flight.



A rare prize is the verbena hardback, *Verbena quintus*, the male of which is the only known creature having an odd number of legs.

Everyone likes a bit of fun now and then, including William D. Barkley, whose specialty of seed-photography has furnished many State agricultural colleges with aids to seed-identification for courses in agronomy. With the clever addition of appendages like legs, heads, antennas and tails, Mr. Barkley transforms seeds into new and sometimes alarming insects and mammals; thus, in the key photograph below, we find that "insects" 1 and 2 are actually seeds of the castor-bean; 3, the seed of *Geum*; 4, the wild sunflower; 5, sainfoil; 6, tic trefoil; 7, snow-on-the-mountain; 8, tall oat-grass; 9, calendula; and 10, the hairy vervain.





The snapping turtle is common from Canada to Florida, and as far west as the Rocky Mountains; it may weigh up to 30 pounds or more, and live to be 25 years old. Turtles, like other predators, are part of Nature's system of checks and balances, and biologists recognize the need for their protection.

## Turtle with a Temper

Snappers have the longest tails of any of the North American turtles; a convenient, and the only safe way, to handle them.

By JOHN H. GERARD

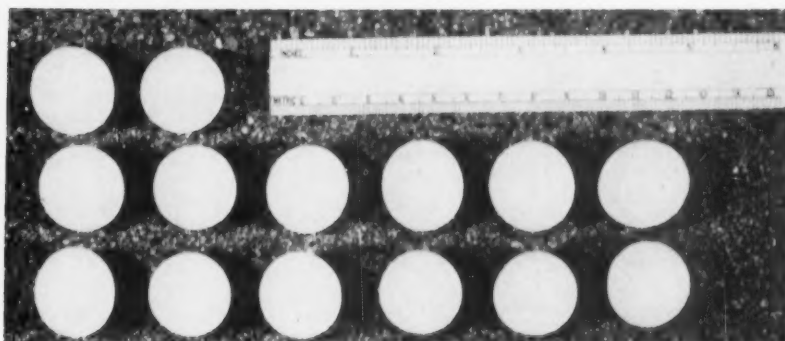
*Photographs by the Author*



WHEN A geologist speaks of a plant, mammal or reptile as being "successful," he is likely to be making a mental count of the number of geological chapters in Nature's eras-long Book through which it can make its way without disaster. In this sense of the word, the common snapping turtle of our quiet, muddy ponds and backwaters must certainly qualify as one of the world's great reptilian successes.

Long before the "terrible lizards"—the dinosaurs of geology's Middle Ages—roamed like bad dreams across the face of the earth, turtles had developed approximately their present forms. The snapping turtle has brought down through the millions of years the widened, overgrown ribs that form his upper shell, the reptilian head, and the armored tail, almost without change. And it might be added that the snapper brought with him into the Present one of the shortest and most formidable tempers of the animal world. Is it not significant that a baby snapping turtle, seconds after breaking from its shell, is able and quite willing to bite? 🐢 🐢 🐢

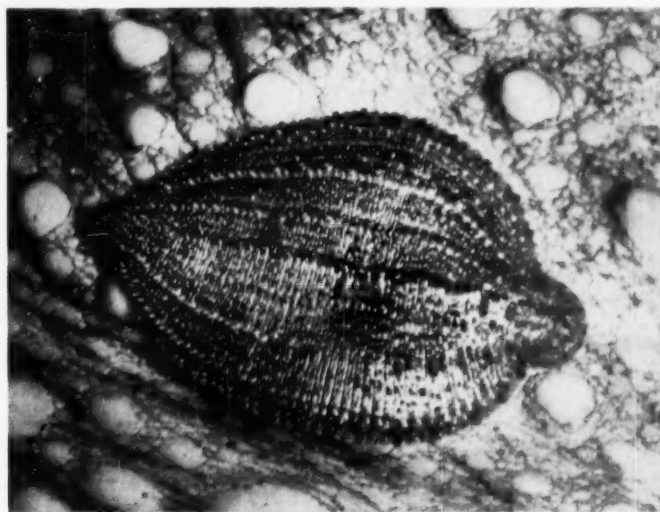




The female snapping turtle goes ashore to lay her nearly round, white eggs that will hatch, in about 85 days, into young turtles reaching maturity in from five to seven years.



Ventral view of tail shows that, compared with alligator snapper, plates are fewer, squarish, and in a straight line.



Snapping turtles are hosts to many parasites, both internal and external; above is shown a leech, *Placobdella*, attached to the leg of a snapper.

During the winter the snapper hibernates in the bottom-mud; but in this unusual photograph, a snapping turtle is shown swimming along slowly under the ice.



This snapping turtle is giving a demonstration of how his race acquired its common name. The sharp, toothless jaw strikes out in a movement too fast for the eye to follow, with a thrust that may carry the turtle off the ground.





## Courtship of the Red-backed Alligator Lizard

*Photographs by Robert E. Blackstone*

The San Diego alligator lizard, *Gerrhonotus multicarinatus webbii*, a race of the red-backed alligator lizard, is common in Los Angeles County, and is frequently found in gardens in the midst of the city where the vegetation is sufficiently thick. They are commoner than most people realize, as they are somewhat secretive in habits. The photographs illustrate the odd courtship behavior of this

species, the male grasping the female just back of the head with his large jaws. The more brilliant coloration of the male, especially in the breeding season, can be seen. This fellow fought off the attacks of a shrike and defied the photographer for several minutes while he dragged his unprotesting mate several feet across a lawn to the protection of a *Eugenia* hedge.



# Hunting Is Being Oversold

## An Editorial

**T**HE United States Fish and Wildlife Service announces that "once again a record has been set in the number of license holders for sport fishing and wild game hunting in the United States. . . ." Among other things, the release comments that "Michigan, the only State to record more than a million hunting license sales, retained its lead in hunting."

The release seems to take pride in announcing these statistics for the fiscal year ending June 30, 1956. It points out that a total of 14,461,848 licenses were sold for hunting. This represented an increase of 270,296 hunting license holders over the total for the preceding fiscal year. Translated into dollars, it is announced that hunters paid \$46,638,220 for licenses, tags, permits and stamps.

These are the official figures announced by the agency entrusted with the Federal aspects of maintaining and managing wisely our wildlife resources. We cannot help but wonder why there should be any pride in such statistics, particularly when they are considered together with other quite startling figures. A few weeks ago the United States passed the 170,000,000-mark in population. Two decades from now there will be 60,000,000 more people in this country, or 230,000,000 of us.

It seems to us that it is sobering to consider what this increase means in impact upon the land for habitation, and for production of necessities to support such a population. Under such circumstances habitat for wildlife is faced with contraction. If this is accompanied by a steady increase in gunning pressure the resultant effect on wildlife populations should be obvious. The increase in hunting licenses during the past fiscal year was approximately two percent. An annual two percent of a growing total can soon add up to a startling gunning pressure on wildlife species that are bound to have far less living space.

This concern about problems created by human population in competition with wildlife gained the attention of speakers in high position at the recent North American Wildlife Conference in Washington. These speakers emphasized the fact that wildlife populations must be maintained in the face of industrial and agricultural progress and competition, and that it will be no simple task to achieve this.


It seems to us, therefore, that we must adopt a new viewpoint of the wildlife situation. We must recognize the plain fact that hunting as a sport cannot continue to be oversold as it is being today. Overselling has

many manifestations. A recent survey was designed to prove that hunting and fishing are "big business," and California asserts that licensed fishermen and hunters spent \$487,000,000 in that State in 1955 for their fun. Most State fish and game or conservation commissions exist on the income from their license sales. To survive and carry on their work they must sell more licenses. Hunting magazines avidly promote sport hunting through their editorial contents and advertising columns, as do most rod and gun writers. Sportsmen's organization make their additions to the pressure.

As a further indication of hunting demands of the future it is disturbing to discover that some youth groups seek to promote interest and activity of our rising generation in hunting. In understandable self-interest arms and ammunition manufacturers sound a similar call, as witness a recent publication prepared for boys and girls and entitled "Shooting Fun for Everyone."

Non-hunters constitute a great majority of the people. No doubt many of these do not give much thought, one way or the other, to wildlife. But there are many who do enjoy seeing wildlife just as a part of the natural scene. Such individuals are not extensively organized or vocal, or, perhaps, especially well-informed about the wildlife situation today and in the future. Nevertheless, they have a stake in that future and the right to be considered.

Evolved from the Bureau of Biological Survey, which was essentially an agency concerned with a scientific approach to wildlife, the U.S. Fish and Wildlife Service has gradually acquired different responsibilities and become an agency primarily responsive to the hunter and fisherman. This is a natural development of the Service's control over migratory game birds, its fine refuge system, its administration of the Pittman-Robertson Act and the Dingell-Johnson Act, and its other concerns for game animals as a crop. As such it has an opportunity for wise leadership that has a vision of the problems of the future.

Sober thought should give the true sportsman pause. But we do not plead the cause of those who find pleasure in sport killing. They are competent to fight their own battles. But we *are* concerned about the future of *all* species of our native bird and mammal life. We believe that that future is black unless we stop overselling hunting and take a sound look at the implications of the decades immediately to come. We saw what a policy of "cut and get out" did to our timber resources. Wildlife cannot survive a "shoot and get out" policy. 



# Is Your Career In Forestry?

By ARTHUR B. MEYER



PHOTOGRAPH BY HAMMON, JENSEN & WALLEN

**E**VEN THOUGH we are turning into a nation of city dwellers, there are still outdoor careers that offer opportunity to young people. In fact, as we have more and more people and a dwindling supply of natural resources, work in resource conservation, a major field of outdoor careers, becomes more important and offers greater chance for real service.

Forestry is the oldest recognized profession in the United States in conservation. The first handful of American-trained foresters started work in the early years of this century. By 1956 it was estimated that 17,000 were engaged in forestry and closely allied fields. Despite this increase in numbers, there appeared to be at least 1000 unfilled openings for trained foresters in industry and government at that time.

The professional forester is a scientist and technician who is playing an important role in modern society. His task is the management of forests and forest lands to supply the vast and growing need for forest products and forest services. These products include wood in its countless forms and uses, water from forest watersheds, and forage for domestic livestock. Forests furnish habitat for wildlife and provide places for scientific study and wilderness inspiration and solitude. Perhaps most important of all intangible values, are the forest's facilities for outdoor recre-

ation for millions of vacationing Americans each year.

The forester, in managing forests so that they produce the greatest possible amount of the goods and services we require of them, needs to be highly trained. He knows about trees and soils, and something about wildlife, watershed, outdoor recreation, and forage production. He knows how to survey land, build roads, harvest sawlogs and pulpwood. He is acquainted with the economics of the forest industries. He is skilled in fighting fires, and in stopping damage from insects and disease. In addition to these and other technical matters, the forester also works continually with people. He supervises workers and directs organizations in govern-

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ment agencies and industry. He works with the general public in the protection of forests, and in bringing about an appreciation of the necessity for the wise use of all renewable natural resources.

Although forestry is concerned basically with land and resource management, individuals engage in a wide variety of work, from scientific research through business administration, teaching, and public relations. Foresters may be employed by Federal and State agencies, by pulp and paper and lumber companies, universities, and by industrial and citizen's organizations. They may work for themselves as consultants. They may work



in fields closely allied with forestry, such as soil conservation, wildlife management, arboriculture, park planning and management, wood technology, certain phases of engineering, and the manufacture and sale of wood products.

Out of the 1956 estimated total of 17,000 practicing foresters, about 7500 were classified as in private or industrial work, mainly with the pulp, paper, and lumber companies, but including 1250 self-employed. A slightly smaller number, 7000, worked for public governmental agencies, of which the largest single employer was the United States Forest Service in the Department of Agriculture.

The professional worker in forestry requires four years of college training leading to a degree. Advanced study is necessary in some fields, like research and teaching, helpful in others. A total of thirty-eight colleges and universities distributed throughout the United States offer professional degrees. Of these, twenty-six are accredited by the professional Society of American Foresters as providing approved courses and requirements.

College training consists of a foundation of scientific, engineering, economic, and social studies upon which training in forestry is based, in a minimum of five technical fields. These include *silviculture*, or the art of producing and tending forests, *forest management*, which

Ranger George Tannehill inspects a stand of virgin loblolly pine in the Winn district near Saline Lake, in Louisiana's Kisatchie National Forest.

PHOTOGRAPH BY UNITED STATES FOREST SERVICE



for June-July, 1957



PHOTOGRAPH BY BILL HEDRICH

Some beginning foresters may be assigned to research work by a forest experiment station of the United States Forest Service.

combines business methods and technical forestry, *forest protection*, *forest economics*, and *forest utilization*.


The United States Forest Service is the leading example of public employment in forestry. Entrance is gained through the possession of required college training, and the satisfactory completion of the federal service entrance examination of the Civil Service Commission. The beginning forester would most likely be assigned to a ranger district—the administrative unit—of one of the country's 153 national forests. There, under the direction of the ranger he would engage in many activities, including cruising (inventorying) timber, surveying, fighting fires or epidemics of insects, planting trees, marking (selecting) timber for sale to wood-using industries, carrying on range forage surveys and improvements. He would find himself concerned with working productively and congenially with others, supervising sub-professional employees and laborers, dealing with users of the national forests, who vary from timber cutters to tourists. Other beginning foresters may be assigned to research work by a forest experiment station of the Service.

Salaries, as of November, 1956, start at \$4210 per year and increase with length of service and promotion to positions of greater responsibility in the Service. A forest supervisor, for example, who administers a national forest made up of ranger districts, has a salary of from \$7570 to \$10,065. Top pay for a regional forester, who directs the work and business of all the national forests within one of the Service's ten regions, may go as high as \$12,690 per year. Some positions, including that of the Chief of the Service, have higher salaries.

Federal service holds out the advantages of permanent career work, liberal vacation and sick leave, and retirement benefits.

Foresters working for industrial and private timberland owners engage in almost every phase of technical forestry, the business aspects of growing, harvesting, and marketing forest products, and related duties.

An industrial forester might be- (continued on page 330)



Through the efforts of a conservationist of fifty years ago, the sixteen acres of rhododendrons in what is now a New Hampshire State park were saved from destruction by logging.

Photograph by the Author

## Beauty of the Swamp

By FRANCES GREEN

WHEN THE creamy white, pink-tipped flower clusters of *Rhododendron maximum* unfold in July, deep within a pine forest on the outskirts of Fitzwilliam, one of New Hampshire's less familiar State parks is transformed into a vision of mid-summer floral magnificence. Within the park that is named for them grow sixteen acres of this spectacular rhododendron, the largest known such concentration in the United States; a virgin growth, believed by some botanists to have been there for several thousand years.

The survival of this great rhododendron swamp, and the existence of Rhododendron State Park today, is due largely to the vision and conservation efforts of Mary Lee Ware, more than fifty years ago. Learning, in 1902, that contemplated logging operations would destroy the rhododendrons, Miss Ware took immediate action. She purchased the 294-acre farm involved, and presented it to the Appalachian Mountain Club. She stipulated that the rhododendron swamp should be held in perpetuity as a public reservation, and that the remaining land could be used as a source of income to maintain it.

The forest suffered severe hurricane damage in 1938, but the sturdy rhododendrons survived, and timber salvage and new growth in the intervening years have hidden the storm scars completely. For forty-five years the Appalachian Mountain Club continued to use the property as Miss Ware had directed. A 200-year-old farmhouse and the surrounding forest became a vacation retreat for club members and their guests, and guest fees and the income from timber harvesting served to cover the expense of maintenance as the donor had hoped. In 1947 the Appalachian Mountain Club gave the property to the State of New Hampshire for use as a State

park, and thereby extended its use to the general public.

Since then several simple improvements have made the park more readily accessible. The two-mile approach road has been widened and improved, and the parking area enlarged as the need arose. In an open grove shaded by towering pines is a secluded picnic area, and there is a simple playground for visiting children.

To see the rhododendrons, it is necessary to leave cars at the parking area and proceed on foot along a mile-long loop trail. This path, gently graded and reasonably smooth for a woods trail, passes under a canopy formed by giant pines and maples whose crowns almost meet overhead, shading the rhododendron thickets. Crossing low-lying damp spots on sturdy low foot bridges, the visitor may enjoy close-up views of the huge clusters of flowers. Beyond, from slightly elevated slopes where fallen pine needles deaden the sound of footsteps, are the more distant views out over the tops of shrubs fifteen to twenty feet tall, spread in tangled profusion over the swampy ground in which they are rooted. Then the bushes close in again to form a thick barrier into which the trail seems to vanish, although actually it has narrowed and turned a sharp corner to pass between encroaching shrubs. Here, as elsewhere in the park, the route of the path was determined by the location of the shrubs, and consideration of its width was secondary to the preservation of the rhododendrons.

Although its flowering rhododendrons are its chief attraction, Rhododendron State Park also includes more than one hundred other varieties of flowers and flowering shrubs. Occasional laurel bushes grow side by side with the rhododendrons, and many other plant varieties may be identified along a short Nature (continued on page 330)



Trees and shrubs provide excellent protection for the rough green snake. Its body coloration blends with the green leaves to offer a nearly perfect camouflage.

## Rough Green Snake

By CHARLES R. KILBOURNE

*Photographs by the Author*

**I**F YOU characterized any snake as being graceful, probably you would hear objections and protests from many people; and yet this adjective well describes *Ophedrys aestivus*, commonly known as the rough green, or keeled green snake. A comparison of the bodies of the various species shows that the unusually slim form of the rough green snake presents a unique and handsome appearance. And if mild tempers of captive reptiles are to be desired, certainly in this respect the rough green far surpasses the rest of the snakes.

The identification of the species is relatively easy because of its green color. The only other snake re-

sembling the rough green is the smooth green snake; and even this apparent similarity of closely related species is dispelled, if we carefully examine the scales of each of them. Upon close examination, the scales of the smooth green snake are perfectly smooth; whereas on the scales of the rough green snake a ridge or keel can be found on each scale, giving the reptile its rough appearance as well as its name.

In making a comparison, location in the field is also important. The smooth green snake is often found in open grassy areas, whereas the rough green tends to be arboreal. In addition, there is a readily distinguished difference in size between the two. The full-grown rough green snake is about thirty inches long, or about twice the length of the smooth green. Both snakes, however, have cream-colored ventral surfaces, mild tempers, and are insectivorous in habit.

The rough green snake seems to be found in greatest numbers in the southern States, but it is appearing with increasing frequency in the North. The northward limit of abundant numbers seems, at present, to be southern New Jersey. The eggs usually are laid in mid-summer, often in July. During early fall, the dark-colored little serpents hatch, and gradually acquire the typical green color of their parents.



The night-hunting rough green snake shows a preference for smooth-bodied caterpillars, but other favorite tidbits include grasshoppers, crickets and spiders.



Rough green snakes will not eat voluntarily in captivity, but gentle force-feeding is successful.

On close examination of the body, a ridge or keel will be found on each scale, giving the reptile its rough appearance as well as its popular name.

Although this slender reptile is normally found in trees or bushes, it may be seen occasionally winding its way across a woodland path or a country dirt road. Its movement on a flat surface appears to be somewhat labored, but once the lower limbs of bushes are gained, the green snake again regains its customary ease of movement. It has an affinity for bushes that is quite remarkable. Experimentally, two rough green snakes were placed in grass about ten inches high, and about two feet from a hedge-row. Several releases were made; and in each case the reptiles steadily made their ways toward the lower branches of the hedge. They immediately began their smooth ascent, climbing with ease, and quickly blending with the color of the leaves.

The climbing ability of the rough green snake should not be underestimated; the following schoolroom example was provided by two snakes that escaped from a carelessly covered cage. The snakes were hunted for several days without success. Finally, the teacher, while leading a group discussion a week after the escape, was interrupted by the upward-pointing finger of a girl who was staring at the ceiling. Everyone glanced upward to the two thin green bodies, as they hung supported by the fluorescent light case above. Seemingly, the snakes had been able to climb the rough cinder block walls of the room to this lofty position.

The hunt for food usually takes place at night, and during its nocturnal wanderings, the rough green snake

is constantly on the alert for insects. It seems to show a preference for smooth-bodied caterpillars, but many other forms of insect life are devoured. High on the list of favorite tidbits are crickets, grasshoppers and spiders.

The rough green snake, in captivity, fasts continuously, and seems to be by far the most difficult of the common snakes to feed. To prevent starvation, it is necessary to force-feed. Fortunately, this is easy with rough green snakes. The mouth is gently opened with a probe, and a living insect, such as a mealworm, is carefully pushed into the mouth. The forward part of the body, up to just back of the head, is held by the hand during the process. When the snake is released, it swallows the insect without difficulty.

The camouflage of the rough green snake is almost perfect. One can look directly at a leafy branch that harbors one of these reptiles, and yet quite often the specimen must be pointed out before it may be seen. An excellent technique, when collecting specimens, is to shake bushes and lower limbs of small trees. The rough green snake will then betray its presence by either partially falling, or by noticeable movement through the branches. Sudden movement of shrubbery will often produce the rather surprising appearance of a specimen.

If you camp, walk, or picnic this year in rough green snake territory, perhaps you will be fortunate enough to make the pleasant acquaintance of this graceful green reptile.

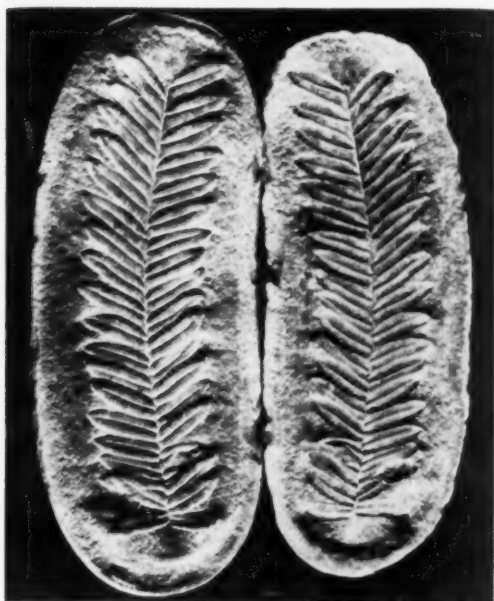


## THE OLD FENCE

Donald Eastman

*Last fall I told the lad that maybe rightly  
The old fence had some reason to be there,  
He laughed and tore it down, called it "unsightly;"  
This spring the little peach-tree's winter-bare.*





*Waste from our coal mines furnishes*

## Strange Keys to the Past

By HENRY N. ANDREWS

*Photographs by John H. Gerard*

The fossil record obtained from coal-balls is fragmentary, but it has revealed much about the evolution of plants and mammals. This is an impression of part of the leaf of a Carboniferous plant that bore fern-like foliage and true seeds.

**I**MPRESSIONS of fern-like leaves and a large variety of plants from rocks of the Coal Age period have long been displayed in natural history museums throughout the world. Such impressions often make fascinating exhibit specimens, and they have helped a good deal in enabling us to create restorations of the forests that so long ago occupied vast areas of the north temperate zone of the earth. However, only rarely are such plant fossils sufficiently well preserved to give us all the clues we would like to have, in order to focus this scattered debris into a picture that is really satisfactory.

Fortunately, there is another source of information, one that reveals more important secrets, and one that has called for correspondingly more laborious and painstaking study. This source exists in the form of aggregations of petrified plants that are found, not in the shales above the coal, but in the coal seam itself, and because these are often more or less round in form they are known as coal-balls.

About a hundred years ago, masses of petrified plant remains were discovered in some of the coals of northern England. Through the studies of a small but enthusiastic group of paleobotanists in that country, a great deal of light was shed on one of the greatest surges of vegetation that ever swept across the face of our planet. Many new and undreamed-of plants were found, fragmentary, as usual, but often preserved with a perfection that had not been encountered previously.

For reasons that are not entirely clear, comparable studies were not initiated in this country until about

thirty years ago. It must be admitted that the long delay was due in some degree to lack of interest on the part of American botanists; but it was partly due to the fact that we are dependent on modern mining methods to obtain the material we need, and such methods date from about that time. To obtain the petrified material, we must have access to the coal; and such access is greatly facilitated by the open-pit or strip-mining operations now scattered across the country from Ohio to Kansas.

Coal seams through this area are found at varying depths below the surface of the ground. Some are



Coal-balls are masses of petrified plant remains that must be removed from the coal before it is marketed. Such "rocks" contain a wealth of information about the plants that produced the coal seam.



First step in the preparation of a coal-ball for study is an exploratory cut with a diamond saw; about five minutes would be required to cut this specimen.



The cut surface is next smoothed on a grinding lap, using an abrasive such as carborundum; the surface must be smooth, but a high polish is not necessary.



After drying for a few hours the nitrocellulose "peel" is removed and brings with it a thin section of whatever plant parts were exposed. The preparation is then ready for examination under a microscope.

actually exposed at the surface along stream banks or hillsides, and others lie hundreds of feet deep. It may be noted that coal-balls have been found in the deep mines, but little of this material is brought to the surface with the coal itself. If a good seam is not more than about fifty feet down, and other conditions are suitable, it may be mined by stripping off the overlying soil and rock with giant electric shovels that claw out twenty or thirty cubic yards at a time.

From the viewpoint of the mine operator, the coal is then ready to be taken out by smaller shovels, and processed for market. But the viewpoint of the fossil hunter is quite different; he sees perhaps several acres of coal exposed, the results of an accumulation of vegetation that took place about 225 million years ago, and which is now accessible for exploration. He may find nothing other than coal; or, if luck is with him, he will see rounded masses projecting here and there, slightly above the general level of the seam. A little work with a pick will reveal them to be masses of "rock" varying in appearance from chocolate-brown to a muddy grayish color; and in them he knows that he will find petrified plants. With a little experience, a fairly accurate estimate can be made in the field of the quality of preservation, but only long hours of laboratory study will reveal exactly what is there. It is quite safe to say that no source of information about plants of the past is less glamorous, at first glance, than the aggregations of petrified plants we call coal-balls; yet there is no source that will produce more spectacular specimens, when properly prepared for study.

We have good reason to believe that these petrifications are representative samples of the great aggregations of plant debris that accumulated in the Carboniferous swamps. For reasons that are still not at all well known, some of this debris became infiltrated with minerals that petrified the plant remains—stems, leaves, seeds and the like—preventing them from being crushed into the nearly structureless surrounding material we call coal. Actually, these coal-balls vary from golf-ball size to masses that weigh several hundred pounds; and in spite of the name, they vary just as much in shape. They are sporadic in occurrence. In some mines they are non-existent, while in others they are abundant; but even in such mines several tons may be found on one visit, while a month or two later, when the mining operations have moved on a few hundred yards, they may be conspicuous by their absence.

As to the minerals involved, there are many; specimens composed chiefly of the carbonates of calcium and magnesium present the finest features of preservation. Coal-balls with high percentages of iron sulfide are all-too-frequently encountered, and here the preservation is generally rather poor. Coal-balls are not welcomed with enthusiasm by the mine operators; they will not burn, and must be removed from the coal. Thus, we often find good collecting at the dumps adjoining the processing plant, where the coal is separated from the rock and graded. At one mining area in eastern Kansas,

coal-balls occur in such abundance that they are used as a base material in the construction of roads. Here our collecting technique is to walk along the sides of the road, examine slightly weathered specimens, and select the more promising ones for study!

When we get the coal-balls back to the laboratory, and our colleagues in other branches of botanical research make unsavory comments about cluttering up the building with "rocks," the work really begins.

Unless a conspicuous structure, such as a large stem, is exposed on the surface, we have little notion as to what is contained within a specimen. The first step is to make an exploratory cut with the diamond saw. This is a rather simple piece of equipment, a circular iron disc with diamond dust embedded in the edge. It runs in a mixture of kerosene and oil at a slow speed, and is messy but efficient. For example, a specimen eight inches in diameter can be cut in about as many minutes. The exposed surface is smoothed on a grinding lap, first with a coarse abrasive to remove the saw marks, then with a finer one, resulting in a surface that is velvety smooth to the touch, but not highly polished. It is then immersed in a very dilute hydrochloric acid for two or three minutes. This etches out a thin layer of the mineral matter, leaving the plant tissues standing slightly in relief. By "slightly" we mean a few thousandths of an inch, and it is important to emphasize here that there is actual plant material present in these petrifications. There is a popular misconception that petrified plant or animal structures are literally and completely "turned to stone." Actually, petrifications vary greatly with reference to the relative amount of organic matter that is present. For example, occasional specimens from certain of the petrified forests in the West may be subjected to acid treatment that will dissolve out the mineral matter and leave the wood much as it existed in life. Other specimens, given the same treatment, will dissolve completely, or nearly so, indicating that little of the original plant tissues remained. And so it is with the coal-balls; the quality of preservation is highly variable.

Returning to our laboratory procedure, the etched specimen is next placed in a tray of gravel or sand and allowed to dry. A solution of nitrocellulose, similar to clear fingernail polish, is then poured over the surface and allowed to harden overnight. In the morning this film may be removed with the aid of a razor—the technique is, in fact, known as the "peel method" of preparing thin sections. Essentially what happens in the



Ferns were abundant in the Carboniferous period; this shows a spore-sac containing numerous spores.

process is that a thin layer of mineral matter is replaced by the nitrocellulose, and we end up with an actual thin section of the plant parts that were preserved.

If this exploratory cut reveals fossil plants that are of particular interest, or perhaps even plants that have never been seen before, the specimen is trimmed and cut accordingly. A frequent question that is asked by visitors to our laboratory is, "What next? Where do we go from here?" The ultimate objective of our study is to gain a better understanding of the plants of the Carboniferous period and to determine how they fit into the general stream of life that came before, and that followed on up to the present. The fossil record is known to be fragmentary and far from complete; it is elusive game that we hunt, yet it has revealed much about the evolution of plants and mammals

that can be learned in no other way. Paleobotany has been called "the last court of appeal" in plant evolution studies, because it is the only approach that gives us a real, if somewhat fleeting, glimpse of the life of the past.

Coal beds may range in thickness from the merest ribbon of black, carbonaceous material, sandwiched between rock layers, to great deposits hundreds of feet deep. Travelers through the American West have often noticed, in the rock highway cuts of mountainous country, seams of coal between brightly-hued layers of shale and sandstone; but such thin deposits are, of course, not worth working at the present time.

The rock formations of the Coal Age cover vast areas and the contained coal deposits are of great economic importance. Detailed studies of the floras of different horizons have greatly facilitated geologists in their work of correlating the sequences of these rocks at different localities. Botanically it is important because we find here the earliest ancestors of several modern families ferns; the diminutive clubmosses, which are so abundant in the eastern woodlands today, were represented by arborescent relatives which existed in vast forests through much of what is now mid-America; the early seed plants were evolving, notably the forerunners of the pines and their relatives.

Our study of this unique and productive source of ancient vegetation is only well underway. We got off to a later start than our English colleagues, but already many new plants have been discovered, and as more and more are revealed by the oily diamond saw working its way through coal-balls from many localities, we shall continue to create a more complete picture of the great Carboniferous forests that gave us coal. 🌿 🌿 🌿



# Return of the Fisher!

By BILL GEAGAN

*Illustrations by the Author*

A PUMPKIN moon bulged softly above the snow-cloaked spruces of Maine's great north woods. The wilderness world that had been a deep black smother was suddenly a beautiful fantasy land of silvered snow, squirming shadows, and small sounds from many sources. The snowshoe hare bounced gaily along in its deep trail to feast and frolic in the clearings. Deer stirred in their white prisons and began to feed again. The owl, bobcat, fox, lynx, weasel and mouse also moved out to meet the night and the never-ending challenge of food. Nature was sounding the tocsin.

Deep in the hollow heart of an old white pine another creature stirred from its bed, ready for its nocturnal prowling. Moving gracefully out on a stout limb, head high, nostrils wide, it sampled the winter night. The rising moon silhouetted the long and powerful body, and the cold winds fingered the dark rich fur. There in all his magnificence stood Pekan, the Black-cat, the Fisher, splendid and mysterious creature of the north woods.

Many others of his kind, in different parts of the woods, also were preparing for a night of wandering and hunting. They had little to fear from the mammals they would prey upon; even the quilled porcupine and the stalwart members of the cat family.

Lightning fast, powerful, and courageous, Pekan was more than a match for any of them. There was, however, one thing he could never match—the vicious jaws of man's cruel steel traps, cleverly placed to catch him.

Unlike the wary mink, the fox and some of the other fur-bearers, Pekan is quite easily enticed into traps. And it is believed by many that the use of traps by the fur hunters of the bountiful past was largely responsible for eventually wiping out the species in much of its original range, and reducing it to a dangerously low level in the remaining areas. Other factors believed by some to have been responsible for the alarming scarcity of this animal were the destruction by lumbering and fire of its deep wilderness habitat, and its relatively slow rate of reproduction—one to four

young in about 350 days, brought forth late in spring.

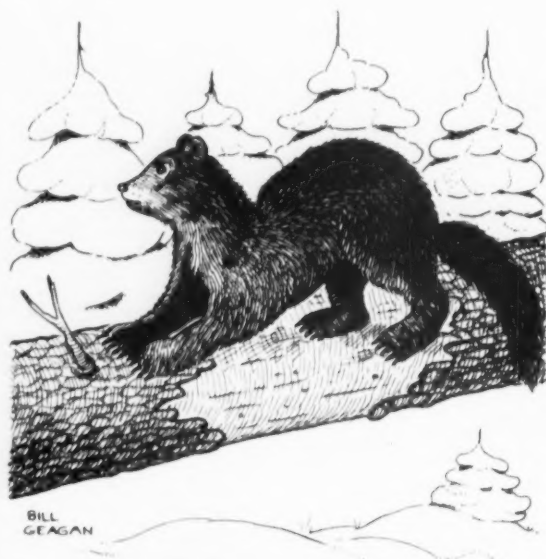
History reveals that when the white man first invaded this country with his axe and saw, the fisher was found quite abundantly over much of Maine, and in the mountainous areas of the East, as far south as North Carolina. The fisher's range dwindled rapidly before the advance of civilization, and by the middle thirties it was described as a vanishing species. Today it is regularly found in only four States east of the Mississippi; Maine, New Hampshire, in the Adirondack Mountains of New York, and, less commonly, in Vermont. It also is found in some parts of southern Canada, from New Brunswick northwest to the lower MacKenzie River.

But now this valuable and interesting mammal, once believed to be nearing extinction, is making a comeback in nearly all parts of its remaining range—a development that has caused even the biologists to scratch puzzled heads. The conservation departments of the areas in which the fisher population is increasing are, of course, happy and interested. And they are encouraging the comeback by limiting the trapping of the fisher and conducting extensive studies in the forests.

The fisher's return to the great forests of Maine is particularly notable. During the middle thirties several other wildlife species of that State also had reached a low point in numbers, including the beaver, waterfowl, some shorebirds classified as game, and the moose.

It was about then that wildlife research agencies began

to be organized in answer to the handwriting on the wall. The Cooperative Wildlife Research Unit, sponsored by the United States Fish and Wildlife Service, was established at the University of Maine, in Orono, as a division of the Department of Forestry, in 1935. The first specific data on the status of the fisher was gathered in 1939, when Clarence Aldous, leader of the Unit, and his assistant, Howard L. Mendall, circulated a questionnaire to Maine's hundred game wardens. Each warden rated the abundance of the big game and fur animals in his district. All but two of the





officers thus questioned reported that the fisher was rare.

Shortly after World War II, more and more fisher reports were received from State game wardens, trappers, guides, timber-cruisers, and wildlife technicians. The fisher, it seemed, was actually coming back from the very brink of extinction where it had so long teetered. During the late forties it continued to increase in numbers, and to extend its range in the State.

Heading the Maine fisher survey at this time was Malcolm W. Coulter, assistant leader of the Cooperative Wildlife Research Unit under Mendall. Encouraged by the strong and puzzling comeback of the fisher, the young scientist, also a good woodsman, launched an intensive study of this mammal in the winter of 1950.

With the assistance of other game technicians, State game wardens and veteran trappers, he uncovered much valuable data. Professor Coulter explains that the range in Maine has been plotted, based upon the catch records and careful track observations. Approximately one hundred and fifty fishers have been carefully examined in the Unit laboratory, to investigate details of reproduction and food habits. Also, the animals have been tracked during the winter further to study food habits, habitat preference, and abundance, he says.

Professor Coulter, and the technicians conducting similar studies in other parts of the fisher's remaining range in this country and Canada, report that the animal eats a variety of foods. The menus, differing but slightly, include porcupines, snowshoe hares, mice, shrews, squirrels, small birds, beechnuts, berries, and the carrion of deer, moose and other mammals.

Professor Coulter applies the proverbial grain of salt to reports that the fisher is a slaughterer of deer. He says a large and very hungry male might take a young or sick deer, but that most of the deer flesh eaten by fishers is from deer that die of starvation or from wounds inflicted by hunters' guns. He never has found fisher tracks in a winter deer-yard, he says. And he adds that the largest fisher he has ever seen in Maine weighed fourteen and one-half pounds, while the largest female weighed six and one-half pounds.

About two-thirds of the male specimens examined at the University have carried porcupine quills. Only fifteen percent of the females showed evidence of having attacked a porcupine. Apparently, Dr. Coulter states, the sharp, barbed quills, so damaging to other mammals, have little or no effect on the fisher for some reason not yet known. More than a hundred have been counted in some specimens; many of them lying between the skin and the body flesh. They also have been found deep in the muscles or lodged against bones, still with no sign of inflammation or harmful effects.

The tough and crafty fighter of the wilderness is not entirely immune, however. He does, on rare occasions,

make a mistake; and when that mistake causes quills to be slammed into the face and eyes by the porcupine's slashing tail, the fisher is often blinded and eventually dies of starvation.

Professor Coulter has examined many fishers, and has followed their tracks through the snow-choked forests of Maine for years, but in all that time he has seen only one live fisher. According to the reports of wildlife technicians in other parts of the present range, they have

had no better luck. Few, indeed, are the photographs of this usually nocturnal animal in its natural habitat.

The range of the fisher in Maine has, in just five years, extended from a small northwestern area over nearly all parts of the State. At least sixty percent of Maine

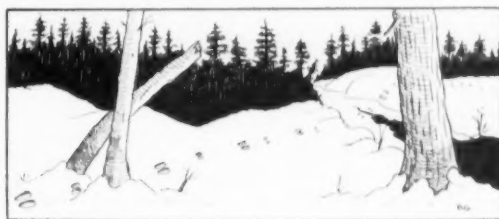
now supports the animals in good numbers. And the increase continues despite a winter trapping period in many parts of the State. Contrary to the popular belief that this animal dwells only in coniferous forests because of its dependence on red squirrels, Professor Coulter points out that it is also being found in many great hardwood areas of the State. And studies reveal that in Maine at least, snowshoe hares, porcupines, and mice are eaten far more often than squirrels.

W. J. Hamilton, Jr., Professor of Zoology of the Department of Conservation, Cornell University, and Arthur H. Cook, Game Research Investigator, New York State Conservation Department, conducting an extensive study in that State, report that "the fisher has increased notably in the Adirondack Mountain region during recent years."

They point out that during the 1940's the species began to extend its range from the mountainous country to outlying areas. They estimate the present population at between 3000 and 4000 individuals, or perhaps about four times that of twenty years ago. Hamilton and Cook now feel that the fisher might, through a program of re-stocking, be reestablished in suitable parts of the Catskill Mountains. They point out that there are wild areas of sufficient size to support a large number of the animals in that vast area.

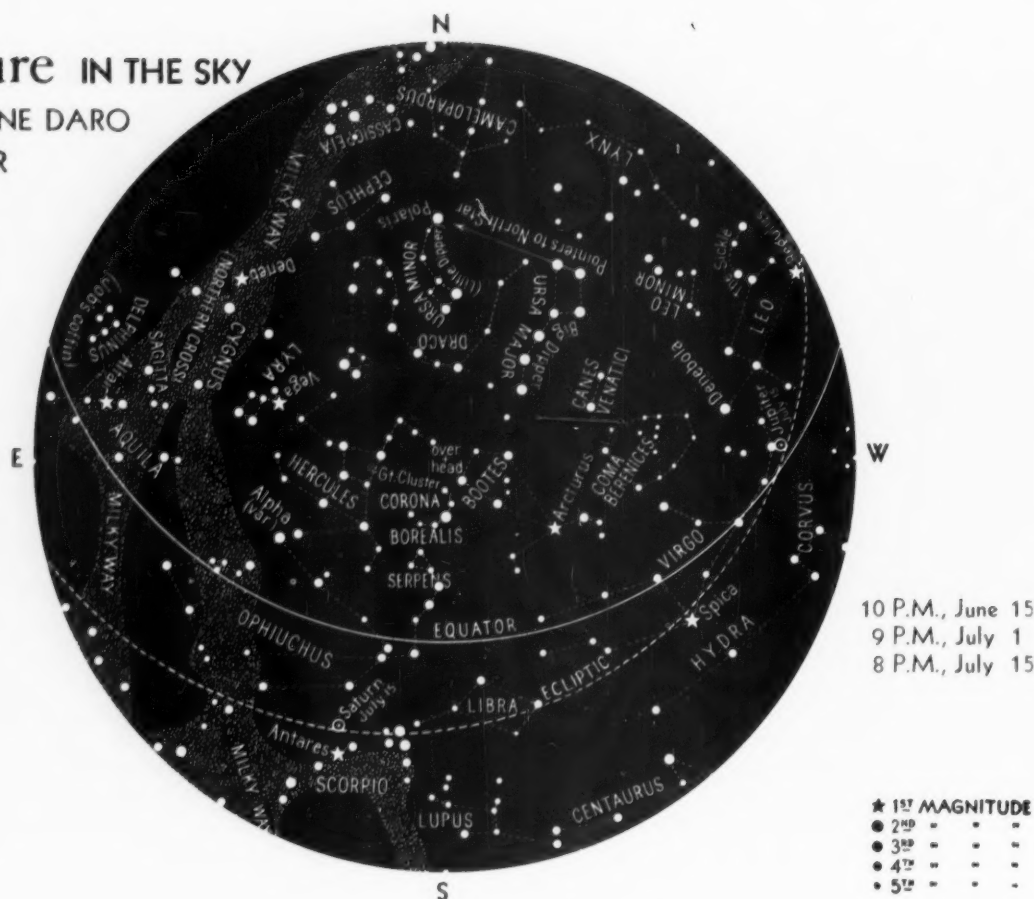
The situation is about the same in the mountainous regions of New Hampshire and Vermont, and everything possible is being done to assist the remarkable comeback. Reports from parts of southern Canada are equally encouraging. The return of the fisher appears to be very strong in Ontario, where Antoon de Vos, of the Ontario Department of Lands and Forests, is leading a study.

Why did the fisher rise from the very brink of extinction and rapidly increase to its present numbers? Was it the protection it has received? Has habitat changed to become more favorable? Or are there natural cycles involved, similar to those observed in the ruffed grouse, snowshoe hare, and several other species? It is another of Nature's many secrets.



# Nature IN THE SKY

By SIMONE DARO  
GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the

map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

## Build a Simple Telescope (I)

**G**OOD REFRACTING telescopes tend to be fairly expensive, because their manufacture requires delicate engineering. They are fine instruments which, in the hands of a serious amateur, will provide countless hours of deep enjoyment. But if you like to look at the sky now and then, without making it a lifelong hobby, you might enjoy building yourself an inexpensive little telescope from cardboard tubing and bargain lenses, at a total cost of about two dollars.

Before you start out, however, it is advisable to familiarize yourself with the different components of a telescope, and with the function each one performs. To that end I shall describe them here. In the next issue, I shall give the specifications, and detailed instructions on how to procure and assemble the parts. In deference to those Nature enthusiasts who prefer observing terres-

trial landscape or bird life, I shall also include a terrestrial version of this telescope.

A refracting telescope consists of a system of lenses. In its simplest form, one lens constitutes the objective, and another one serves as eyepiece. In more elaborate instruments, both objective and eyepiece contain a group of lenses chosen and arranged in order to improve the performance of the telescope.

Lenses, in general, may be classified into two groups, converging lenses and diverging lenses (see fig. 1). Regardless of their shape, converging (or convex) lenses are always thicker at the center than they are at the edges. Diverging (or concave) lenses, on the contrary, are thinner at the center than they are at the edges.

As the name indicates, a converging lens causes a beam of parallel light to *converge* toward a point called the

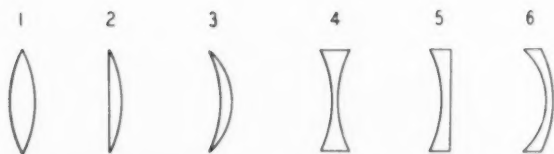


Fig. 1. Converging lenses: (1) double-convex; (2) plano-convex; (3) positive meniscus. Diverging lenses: (4) double-concave; (5) plano-concave; (6) negative meniscus.

focus. Similarly, a beam of parallel light passing through a diverging lens will appear to *diverge* from an imaginary point called the focus (see fig. 2). In both cases, the distance between the center of the lens and its focus is called the *focal length*. In diverging lenses, the focal length is conventionally considered as being negative, and is always written with a minus sign preceding it.

The objective of the telescope is the lens located at the far end of the instrument; that is, the end that is turned toward the sky. It must be a converging lens because the light beams coming from very distant objects are essentially parallel, and must be brought into a focus in order to form an image. The objective performs the same function as the human eye. When the latter looks at an object, the light rays coming from that object are focused on the retina by the eye-lens. The advantage of the telescope objective over the human eye is that it has a larger surface and can thus gather more light. The *light-gathering power* of an instrument is in direct ratio to the size of its objective. A telescope will thus enable one to see fainter objects than with the naked eye. A plano-convex lens is usually chosen if a single lens is used as objective. It causes fewer distortions than a double-convex one.

The eyepiece is located at the other end of the telescope. As its name indicates, it is the end through which the observer will look. The role of the eyepiece is comparable to that of a magnifying glass. It is used to enlarge and view the image formed by the objective. The magnifying power of the instrument is equal to the quotient of the focal length of the objective divided by that of the eyepiece. For example, if the objective has a focal length of 270 millimeters and the eyepiece has a focal length of 27 mm, the resulting power is 10. The object will be enlarged ten times, which is equivalent to saying that it will look as if it were at one-tenth its real distance. Stars, of course, are so far away that they are pin-points of light, and no enlargement will give them any greater size. They only will look more brilliant, and fainter ones will be seen. One sees from the above discussion that it is possible to vary the power of the telescope merely by switching eyepieces.

In a terrestrial telescope of simple design, a concave lens is used as the eyepiece. Its distance to the objective should be equal to the numerical *difference* of their respective focal lengths (see fig. 3a). This arrangement enables the observer to view the image "right side up." This was also the arrangement adopted by Galileo in his



Fig. 2. Left, the path of a light ray through a converging lens. Right, the path of a light ray through a diverging lens.

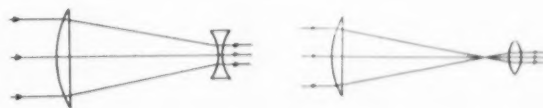


Fig. 3a. Left, the simple terrestrial (Galilean) telescope. Fig. 3b. Right, the simple astronomical (inverting) telescope.

original telescope, and is still used in opera glasses. It has been abandoned for astronomical telescopes because of its narrow field of view.

Nowadays, simple astronomical telescopes use a convex lens for an eyepiece. This lens is placed at a distance from the objective equal to the numerical *sum* of their respective focal lengths. The image (fig. 3b) is reversed—an unimportant fact in viewing the sky—but the field of view is larger than in Galileo's version.

In my next article, I shall give detailed specifications for constructing both a terrestrial and an astronomical telescope similar to those described here. In the meantime, if you are interested in this project, I suggest that you begin saving all the cardboard mailing tubes (one and three-quarter inches in diameter, or smaller) that come your way. If the lady of the house objects to this clutter, threaten her with plans for grinding a telescope mirror instead. *That* job is so messy that she is bound to give in to the lesser evil.

The Sun will reach the summer solstice on June 21, at 11:21 A.M., Eastern Standard Time.

The New Moon will occur on June 27 and July 27, and the moon will be full on June 12 and July 11.

The Earth will be at aphelion on July 3. On that date it will reach the point in its orbit which is farthest away from the sun.

There will be two meteor showers worth watching for: The Draconids on June 28, with maximum zenith rate of 12 per hour, and the Delta Aquarids on July 29, with a maximum zenith rate of 20 per hour. Both nights will be moonless, a condition most favorable to the observation of meteors. A few Perseids may also begin to appear at the end of July.

Mercury will be a morning star in June, and an evening star after July 4. Venus will be an evening star in June and July. Both planets will be poorly placed for observation during those months, although it may be possible to see Venus low in the western sky, shortly after sunset, in the latter part of July.

Mars will set in the west about two hours after sunset on June 15, one hour after sunset on July 15. On July 23 it will be one-tenth of one degree (continued on page 332)

# Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University,  
and Director of Nature Education, The American Nature Association

## Current Seam-busters

PERIODICALLY IN our lives tensions build up until it feels as though something must give. This seems to be particularly true of the spring and early summer of the year. Income tax reports have to be made. Graduate students write in saying that they want you to fill out a questionnaire that they can use in finishing their doctor's thesis that "is due shortly." Summer school students, many of whom you have forgotten, write indicating that your support is needed to get financial backing for a summer program. A neighborhood boy whose activities for the last few years are wholly unknown to you asks that you recommend him for a job the nature of which is completely foreign to you. A professional organization of which you have been a member for some decades writes that "we are seeking the benefit of your highly valued opinion about the criteria that should be used in selecting supplementary reading materials for intellectually gifted high school students." They add that an "immediate reply is essential" because they have been assured of a grant of \$1000 upon completion of the study. Another letter indicates that a professional group has been "encouraged by several agencies to undertake research studies which may be financed by such groups as the National Science Foundation."

Ironically enough, these offers of generous financial support for nebulous projects come at the very time income taxes are being paid to support a generous number of these projects. I would suggest a variation in timing another year if I am to be spared a nervous breakdown. Do not get me wrong on this. I am in favor of generous support of well-thought-out, valid projects, but when a group writes that they have been encouraged to undertake unnamed activities to be supported in part by my income tax I am, to say the least, disturbed.

## Pork barrel technique

Honestly, in spite of staged demonstrations I see over television and get from other media of mass propaganda, I do not believe that the average school person wants to resort to the pork barrel raiding technique to advance the cause of education. If our field of human endeavor has reached a point where we must support some of these activities, then it seems to me that we have lost our claim to public support.

The book questionnaire, which lies beside me, asks my reaction to thirteen unclassified effects the book may have on the reader, and to ten qualities that should be held up as desirable in the book. I am asked to react to the suggestion that a book for use by high school students should be worth owning, should be accurate and authoritative, should be wholesome, fair, grammatical, easy to read, printed well on good paper, well illustrated, not too lengthy and of such a nature that it will enrich the usual high school course. It seems patent to me that any book worthy of support by a professional group should automatically have to have these characters. What I cannot understand is why any organization with a thousand dollars to give away should give it to any group completing such a study. I admit that some of the points raised have not been descriptive of much of the work of some members of the sponsoring group, and if this study will make them realize their own shortcomings it may be worth a thousand dollars. But I still think that the idea is rather ridiculous.

A book, first of all, should have a message. It should not merely duplicate what is available in other books. It should be available at a reasonable price, and may well and adequately develop some one facet of a field of human knowledge that is integrated with what other books have done or may do. Of course, it should be up-to-date even though its

value here may be temporary in a rapidly developing field. Of course, it should not avoid controversial matter any more than it should err in the realm of propaganda.

## Value of books


In his *Five Days and an Education*, which, I assume, was never read by the committee preparing this questionnaire, Dallas Lore Sharp presents an idea not suggested by the outline given. His first investment was in a book that he bought with funds raised by selling junk. He said, "This investment in books was tremendously significant, committing me to books as one of life's rich resources; and confirming me in my love of the out-of-doors as by some solemn laying on of hands. To bring a boy and a book together is to make a match in heaven; and to cause him with all his earthly goods that book to endow is to leave him intellectually happy ever after." He says: "Reading a book is a more solemn business than the writing of it. The contract ought not to be entered into lightly, but seriously, for better or worse, till death do us part."

Even for the sake of a grant of \$1000 we cannot even want to reduce the evaluation of a book to a stereotyped consideration of self-evident values and call it a day. Unless a book changes us, or confirms us in some way, it has little value and what it may do to me it may not do to you. Who can say what the value of a book may be? Certainly not a group that once failed to protest the validity of a study made by one of its members who asked in a questionnaire: "When one insect eats another is it harmful or injurious?" The tragic part of all this is that so few persons seem to see anything funny about it all.

When I officially retired from my position on the faculty at Cornell, five years ago, to devote my time to more concentrated constructive work, William Vinal wrote telling me what a snare and delusion retirement might be. He was right. Subsequent to my Cornell retirement I retired from the National Wildlife Federation. Since that time I have never been so busy in my life. I hardly dare retire from anything else for fear that retirement will mean more acceleration and I just cannot take that without "busting out at the seams."

Some day I hope to have time to do some of the many things I retired



to do. When that time comes I assure you I will not put much time on filling out questionnaires to help in undefined studies being supported, in part at least, by income taxes that I have to pay whether I like them or not. A reasonable income tax to support needed public projects is wholly sound. An intelligent inquiry into what constitutes a good book is entirely worthy, but if next year I get another questionnaire sponsored by a group that has been encouraged to seek financial support of Federal funds at the time when I am forced to help fill the Federal coffers, I am afraid I will "bust a seam" unless the whole program for 1958 is better than the one I am experiencing in 1957. 

## We Can Help

By JANE HUTCHINSON

AS THE vacation season approaches and people seek a refreshing dose of Nature, it seems timely to mention ways by which we may prevent many needless casualties to our wildlife. No special legislation must be fought for, no special knowledge is required, and little effort needed. We need only the desire that we and our children may *always* have the pleasure, as we wander in the woods and fields and mountains, of seeing some of the wild creatures that make those places fascinating. Ordinary people like you and me can help. Here is how:

When we camp or live in areas where skunks, woodchucks, raccoons, foxes, squirrels, and chipmunks are likely to be (which actually is almost anywhere), wash all empty food cans before you get rid of them. Use a vegetable brush, if necessary, and wash thoroughly, removing both food and odor. Several times we have pulled a tin can or glass jar from the head of a woodchuck or a skunk that had been trying to get at the food remnants in an empty container. Certain death, either by some predator, or by suffocation and starvation, faces animals thus trapped.

You can help in another way; cut the lids *completely* off cans. One evening last summer we heard an unusual noise at our bird and mammal feeding tray—a clanking, tinny sort of noise. We found a raccoon, its right front foot caught in a tin can, the lid of which was only partly cut and had been pushed down

into the can before disposal. Since this particular animal was somewhat friendly, it was possible, after a couple of days, to remove the can but only at the cost of rather badly lacerated toes. But the final result was serious. The animal reappeared after a long absence with only a stump where its right foot should have been. And a raccoon without both front feet is really handicapped. It has no thumbs, only fingers which must have resistance opposite them if they are successful in picking up food. This animal pushes one front foot toward the opposite foot to pick up something, while we use four fingers with the thumb pushing toward them.

A fine slogan dealing with can disposal is one that a troop of Boy Scouts in Endwell, New York, uses on its camping excursions—"Burn, Bash and Bury." General adoption of this policy may be too much to expect. But you can spread the word.

## Personalities

By resolution of Congress, Dr. Arthur H. Compton, noted scientist, has been re-elected for a six year term on the Board of Regents of the Smithsonian Institution; also appointed to the Board is Dr. John Nicholas Brown of Providence, R.I., an authority on cultural and business matters. . . C. R. Gutermuth, vice-president of the Wildlife Management Institute, of Washington, D.C., received the Wildlife Society's Aldo Leopold Memorial Award for distinguished service to wildlife conservation during the twenty-second North American Wildlife Conference in Washington. . . Frank G. Ashbrook, veteran of forty-two years of Federal service as a biologist in the wildlife research branch of the Fish and Game Service, retired early in 1957. . . Assistant Secretary of the Interior Ross L. Leffler announces the appointment of Robert H. Johnson, assistant director of the Fish and Wildlife Service since 1955 and formerly prominent in New England conservation activities, as special assistant to the Commissioner of Fish and Wildlife.

## World Day for Animals

Word comes from E. Clifford Pratt of 54 Eagle Road, Toronto 18, Canada, that World Day for Animals will be observed October 4, 1957. This occasion is also known as St. Francis Day for Animals.



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# THE Nature CAMERA

By EDNA HOFFMAN EVANS

## Color-time is here again

I WENT TO A camera club judging session the other night, and the events that happened there were the immediate motivation for this particular "Nature Camera" section.

A second, more general motivation resulted from a look at the calendar. Summer vacation time is approaching and that means more people will be taking more pictures in the next few weeks—pictures of new places, new scenes, of activities and subjects they will want to remember and re-enjoy long after vacation time is over. Many of those vacation photographers will be using color film.

In this section I want to try to combine several different ideas. These ideas, in the main, revolve around three questions: What makes a good color picture? Which techniques can be used to the best advantage? How can one get the best results from color photography?

To tackle the first question: What makes a good color picture? By "picture" I mean a color slide or transparency that is best seen through a viewer or by projection on a screen. Color prints—"pictures" in the more usual sense—can be made from these transparencies if the owner so desires.

Let us return to the first motivation; namely the camera club's slide judging session. There were three sets of slides to be judged that night. One set was to go to an inter-club contest. The subject matter was unlimited—any good color slide could be considered and six were to be chosen from a group of more than fifty entries.

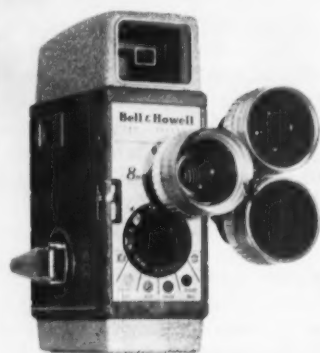
The final results were two landscapes, one tabletop arrangement, one still life, one pattern shot, and one shot that depended solely on colored lighting on a cut-glass perfume bottle.

### People differ

The comments of the committee as they determined the "in," "out," and "hold" selections were interest-

ing. They made me aware once again, as I have been made aware many times before, that people have different likes and dislikes, and a picture that appeals to one person may leave another completely unmoved.

Our club is not exclusively a Nature club. Most of us, though, like Nature subjects. One rugged individualist, however, spoke out in meeting recently and said he was "sick" of Nature scenes (he likes to take portraits). The rest of us listened somewhat aghast, as though what he was saying was downright blasphemy. It only goes to show how different people's tastes can be.



Bell and Howell's Monterey 252TA 8mm turret movie camera.

Despite our wide divergence of interests, the contest committee was able to decide on six entires. What, then, were the features that those six shots shared in common that made us agree on them?

First, they had *impact*. There was something about each of them—some arresting quality—that caught and held our attention when they were projected on the screen.

Second, they had *interest*. Each one told a story, created a mood, or satisfied some sort of aesthetic feeling in a way that made it better than the slides that were rejected.

Third, the *composition* in each of them was good. Lines led into the picture, objects were placed somewhere other than dead center, areas of bright color were balanced against other areas of less brilliant hue, or a contrasting color was introduced to give variation. In color shots balance and contrast are equally (if not more) important than they are in black-and-white pictures. Besides all this, the pictures were not "cluttered" and the backgrounds were not "busy." That is, there was a simplicity, a lack of distracting detail, a definite and unmistakable focus on the main subject.

Fourth, the *technical quality* was of the best. Each slide showed correct exposure, proper lighting, and true color rendition.

### Single subjects

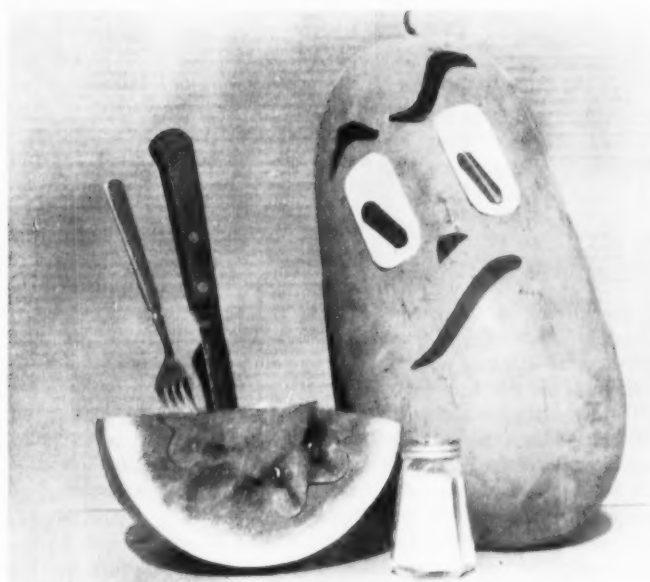
The second batch of slides met the same yardsticks of judgment, with one additional qualifying factor. The subject here was "water," and water had to be the main actor in the picture. On that basis, several good shots of waterfalls were rejected because the water was not the chief feature. A waterfall picture, the committee decided (unless taken so close-up that little else showed) was really a landscape. Rejected also was a shot of a red speedboat, on the grounds that the boat, and not the lake it was cruising on, was the main subject. Likewise rejected was a shot of a tree on a lake shore—again the criticism was that the tree, not the water, was the chief center of interest.

The most controversial slide was one taken by pointing the camera directly down from a bridge at the blurred reflection in the water below. That was all it was—just a picture of a blurred reflection. But it was a picture of water, and it was unusual. So, while no one liked the shot well enough to have it framed and hung on the wall at home, it went into the contest because it was so different.

### Artistic freaks

That quality of being "different" brings out another point I want to make. Sometimes the salon shots or those chosen for contests are not "pretty" or "scenic" or even "soul satisfying." Some of them are artistic freaks chosen actually because of their freakishness.

The third set of slides consisted of portrait studies. Since, admittedly,



This black-and-white shot illustrates several of the factors the color photographer should keep in mind before clicking the shutter.

this is a subject unto itself, I will not discuss the techniques of good portraiture here.

In taking our vacation pictures this summer we must remember that not all of them—indeed, very few of them—will be salon or contest possibilities. In the main they will be pictures for the record. We will take pictures that show our good times, pictures of people, places, and things that we want to remember, pictures to show to our friends when vacation days are over. Even so, we will have better pictures to enjoy if we bear in mind the four salient points of impact, interest, composition, and technical quality.

In the effort to further illustrate these points, let us consider the picture used to illustrate this section. I took it in both black-and-white and in color; and, as can easily be seen, the reproduction of the black-and-white print is not very satisfying. The color slide was much better.

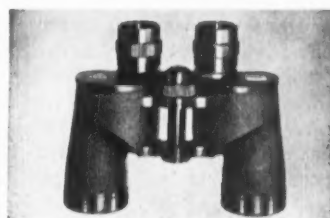
In the first place, this is a picture that needs color to bring it out. It tells a story—a humorous one, I hope—not necessarily just of how a watermelon feels when it is about to be eaten, but of how anybody feels when he anticipates something that frightens or dismays him. It may be the prospect of making a speech, of asking the boss for a raise, of tackling some problem with the outcome not at all certain. As we anticipate the frightening situation we feel just as the watermelon looks.

The composition is all right. The big melon is balanced against the smaller portion with the knife and fork to make up the difference. The salt shaker divides the two, yet it also ties them together. In black-and-white the picture does not have enough contrast—the colors are all much the same value, so far as the Gray Scale is concerned. (The Gray Scale is a chart that shows the different values of colors in terms of gray. This is done in eleven steps or gradations, beginning with black at the bottom with a value of "0" and ending with white at the top with a value of "10.") In the watermelon picture there is not much black nor much white—the eyebrows and the salt represent the widest extremes. So far as the rest of the picture is concerned, there is not much difference in value, except in the knife handle.

#### Color balance

In color, however, this similarity of value is not so evident. The red of the cut watermelon contrasts with the green of the uncut one—red and green are complimentary colors—and a light blue-gray background provides the third complementary color. The brown knife handle, in a way, is the combination of all three colors, thus tying them all together. The white of the salt gives contrast, but it does not stand entirely alone; for the white of the eyes and the near-white of the edge of the cut melon serve as tie-in points for it.

## Binocular Headquarters



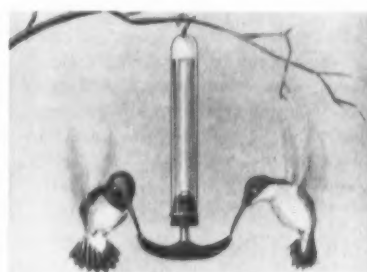
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This shot, of course, was one set up and made to order. It was planned purposely to show various things. Landscapes, scenes, vacation shots in general, cannot be so arbitrarily arranged. Nonetheless, with a little care and artistry, each of these subjects can be presented in the best possible way if the earnest photographer will keep in mind the factors that enter into good picture taking and good color composition.

Beyond all others, remember the following and your vacation shots will not be disappointing.

Take time to compose, to find the best angle and the most satisfactory light. A picture worth keeping is worth working for.

Use the right kind of film—daylight for outdoors, indoor film for inside shots. Use the right kind of flash bulbs, too. The brand of film you use—Kodachrome, Ektachrome, Anscochrome, or whatever—does not matter as long as you determine the kind you like best, know its potentialities, and shoot accordingly.

For color, unless your judgment of light intensity is exceedingly acute, depend on your light meter. Many a vacation picture sequence has been ruined because somebody thought his light-sense was better than that of a photo-electric cell.

Take care of your film and your camera. This final bit of advice comes directly from the Ansco News Bureau. It points out that high temperature and humidity are the natural enemies of color film. In the factory and during storage before sale the film is carefully protected by air conditioning. The user may give his film the same protection by keeping his supply of unopened rolls in the refrigerator. This protects against deterioration from extreme heat or humidity. Films so protected are most likely to produce the sparkling, natural effect that is so desirable. The film should be removed from the refrigerator about 24 hours before it is used.

Beyond all else, Ansco warns, film in the camera or out should not be kept in the glove compartments of automobiles, nor on the shelf under the back window. Once color film has been exposed, it should be developed as soon as possible. Exposed film should not be left in the camera for weeks while the camera owner waits for an opportunity to

"finish" the roll. To do so is to run the risk of damaging all the other pictures on the roll.

And so, with these final words of advice—here is wishing a happy vacation and a successful picture-taking summer to all. ♪ ♪ ♪

## Dragonflies

(Continued from page 301)

Gradually the flying surfaces expand, and then stiffen and dry. The sunlight glints on his shining wings as green darter takes off and flies swiftly and surely across the pond. Overnight he has been transformed from a crawling underwater creature to a flashing jet of the air. He has never known flight before, but there is nothing he needs to learn about it. From the moment his wings are ready, he is a complete master. ♪

## Forestry

(Continued from page 315)

gin his career with a pulp and paper company as a timber estimator, and eventually become vice-president in charge of land management. Usually he is a timberland manager, and has much to do with planning or supervising logging or pulpwood cutting. He must know how much and what kind of timber is on the land, and how fast it is growing. He must protect it from natural and man-caused damage, and plan where, when, and how much to cut. His primary job is to supply the mill or plant with a continuous supply of wood while maintaining and improving the ability of the forest to grow wood.

Foresters in industry are also found in numerous capacities not directly related to technical work, but making use of a knowledge of it. Some employers have found that a forestry education fits employees for a wide range of positions in administration and business activity.

Salaries in private work vary quite a bit, as does the nature of the work. A starting salary, however, of about \$4000 to \$4500 can be expected. As the individual progresses in experience and responsibility income comparable to, and often greater than, public employment follows. Foresters in charge of company forests, for instance, may receive \$7500 upward; those in executive positions from \$10,000 to \$15,000.

Regardless of the employment, forestry offers healthful, interesting, varied, and active work in the out-of-doors or in jobs relating to it. Because of the large variety of work included, individuals are able to specialize in fields suited to their interests. The pay is adequate, and the trend is toward higher pay at all levels because of the increasing demand for trained men. Correspondingly, the opportunities for a person to make the most of his abilities are excellent. The long range value of the work makes it a profession of public service; and there is every reason to predict that as our population continues to grow, and the demands on our resources become greater, it will become more vital each year.

To top it all off, it can be said most emphatically that foresters like their work.

A detailed discussion prepared for prospective foresters, their parents, and counselors is available in the bulletin *Forestry as a Profession*, for sale at twenty-five cents per copy from the Society of American Foresters, Mills Building, 17th Street and Pennsylvania Avenue, N. W., Washington 6, D. C. ♪ ♪ ♪

## Beauty

(Continued from page 316)

trail, near the picnic grove, where specimens have been labelled. For those who wish to explore the park further, several trails branch off the loop trail. Perhaps the most popular is the summit trail, which continues one and one-half miles to the top of Little Monadnock where, on fine days, a majestic panoramic view of southern New Hampshire may be seen, its rolling countryside sweeping toward 3600-foot Mt. Monadnock, seven miles away.

Rhododendron State Park may be reached by turning west at the junction of Routes 12 and 119, near Fitzwilliam, and following the signs about two and one-half miles to the park entrance. There is a service charge of twenty-five cents for adult visitors; children under 12 are admitted free. The park opens June 15, and, depending upon weather conditions, usually closes after an early October foliage display which, some believe, is almost as spectacular as the mid-summer blooming of the rhododendron. ♪ ♪ ♪



### Conservation School

Conservation education courses are being offered by the New Jersey State School of Conservation through summer courses held at Stokes State Forest, Branchville, New Jersey. Greatest emphasis is placed on conservation at the sessions to be held August 12-23. Information with respect to this opportunity may be obtained by writing to the School at Branchville.

### Refuge Program

A bill for a 10-year program of land and water acreage acquisition, designed to add four million acres to the Federal system of waterfowl refuges, has been introduced in the House of Representatives by Rep. Henry S. Reuss of Wisconsin. Rep. Reuss says that unless Congress acts now greatly to expand the government's efforts to preserve and restore waterfowl habitat, "the next generation may see no waterfowl to preserve." His bill would finance the program—estimated to cost \$160 million—by requiring that all federal duck stamp receipts and commercial earnings from waterfowl refuges be used for the purchase of additional refuge acreage, and would increase the duck stamp fee from the present two dollars to three dollars.

### You Can Yodel

According to Magnus E. Bucher, 1146 Pleasant, Boulder, Colorado, any mountain-lover should be able to yodel. What is more, asserts Mr. Bucher, "Anyone Can Yodel." This, therefore, is the title he has given to an interesting little 20-page booklet, which he offers for one dollar to any aspiring yodeler. It seems it is largely a question of the proper breathing.

### Nature Films

Photo and Film Library, Inc., of 149 E. 69th Street, New York City 21, has released the first thirteen 16mm color films in a series of thirty-nine entitled "Secrets of Nature," the photographic work of Roy Pinney, naturalist. These thirteen-minute sound films explore some of Nature's little-known life in an educational as well as entertaining manner; a list of subjects may be obtained from Photo and Film Library, Inc.

### Everest Pak

Incorporating all the basic features of the packs used in the conquest of Mt. Everest in 1953, the Himalayan

Pak Company of Monterey, California, has introduced the Everest Scout Pak. It weighs only thirty ounces and is collapsible for storage. It comes in two sizes and three different colors. Full details from Carson Roberts, Inc., 8811 Alden Drive, Los Angeles 48, California.

### Bulletins

"The Critical Need for Statesmanship in Conservation" is a pamphlet-form reprint of a forthright statement presented to the 1956 annual meeting of the Recreation Conservation and Park Council at Pittsburgh, Pa., by Fred Smith, Director of the Council of Conservationists, concerning the economic and political considerations in the conservation battle. From the Council of Conservationists, Inc., 588 Fifth Ave., N.Y. 36.

"Tunas and Tuna Fisheries of the World" is an annotated bibliography by Wilvan G. Van Campen and Earl E. Hoven, listing the important literature of the period 1930-1953 dealing with tunas and their fisheries in all parts of the world. Fisheries Bulletin 111 of the Fish and Wildlife Service, 45 cents from the Superintendent of Documents, Washington 25, D.C.

"The Problem of Water" is a 31-page reprint from the 1957 Britannica Book of the Year by Roscoe Fleming, free lance writer, and urgently suggests a new national policy concerning the use of a vital natural resource, water. Obtainable from Roscoe Fleming, 43 South Clarkston Street, Denver 9, Colorado.

"The Timber Supply Situation in Georgia," by Robert W. Larson, is Forest Resource Report 12 of the United States Forest Service, outlining the present forest conditions and problems in Georgia, the South's largest producer of pulpwood and lumber. Fifty-two pages and colored map, 55 cents from the Supt. of Documents, Washington 25, D.C.

"The Sierra Club—A Handbook," now in its fourth printing, is the story of the Sierra Club—"the principal activities of its members... and how they have developed," in the words of David R. Brower, its editor. The last edition of the "Handbook" was printed in 1955; this edition adds several new chapters about the Sierra Club's national activities and its role in conservation, and includes a 16-page section of Ansel Adams photographs. It is \$1.00, from the Sierra Club, San Francisco.

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## Sheep Mt.

(Continued from page 298)

weeks, months and years, those men, women and children who lived in Kelly and along the Gros Ventre came to think of the dam as safe. The water behind the dam found a natural spillway, and within a few weeks after the slide, the stream—crystal pure again—was back in a new course down the canyon and by the town of Kelly.

But an invisible sword of Damocles hung over the heads of all those people who lived in and near the little village. The winter of 1926-27 was again a hard one, and all the mountains surrounding Jackson Hole wore a deep and snowy mantle of dazzling white. Spring came late, but the warmth that went with it melted the snow and made the low-hanging clouds pregnant with water. Two years after the fall of Sheep Mountain, the rains came again. The lake behind the dam grew dark, stormy and menacing.

Many of Kelly's residents became fearful once more, and sought shelter at higher levels. Others scoffed at possible danger, placing their faith in the big natural dam. Among these were Max Edick, a bachelor rancher; Mr. and Mrs. Hal Kneedy and their six year old son, Joey; the widow May Lovejoy, and her sister Maude Smith; Jim F. Almy, a young rancher who sent his wife and two children to Wilson, ten miles away (just in case); and a friend of Jim's named Clint Stevens, who was yet too young to be married.

All of these people died at noon on the eighteenth day of May, 1927. The great dam did break under the irresistible pressure of a thousand million gallons of pushing water. With a screaming crack that roared out of the mountains over the Jackson Hole country like thunder, the barrier sundered and a foam-flecked, debris-studded fifty-foot wall of white water churned its way down the canyon to engulf and devour Kelly and those who had stayed. By nightfall, all that was left of the town and its people was the tilting steeple of the church and the roof-tree of a house, resting bleak and lonely in a vastness of broken trees, rocks, sand, mud and desolation.

Eventually, Kelly was rebuilt, but not in the same place. The people are different people now, but the great scar on Sheep Mountain is

unchanged; still raw and gaping. The rest of the broken natural dam is still there, covered now with low trees and underbrush, but there is only a small lake behind it. The Gros Ventre river, in its new bed, rushes just as happily as it did ten thousand years ago to join its nearby brother, the Snake.

Thus fell Sheep Mountain, and thus died eight American citizens, their homes, their village and their dreams, although the world little noted and but briefly remembered what happened there. No greater landslide has ever been known by the white man on this continent. In this one fact, if in no other, there is significance in the fall of Sheep Mountain.

♦ ♦ ♦

## Telescope

(Continued from page 325)

south of Mercury, but this configuration will be hard to see.

Jupiter, in Virgo, will set at about midnight on June 15, and at about 10 P.M. on July 15. It will best be seen in June, when it will be found in the southern sky in the early evening.

Saturn, in Ophiuchus, will appear very close to the moon on June 11, and again on July 8. In the month of June, it will be visible almost all night, setting shortly before sunrise on June 15. In the month of July, it will be found low in the south at sunset, setting in the southwest at about 1:30 A.M. Look for it to the north-northeast of Antares. ♦ ♦ ♦

## Jimmy's 'Coons

The great American names in the history of the conservation movement were men—like John Muir, John Burroughs and Henry Thoreau—who have felt a close kinship with Nature; perhaps, to use other words, they were more than ordinarily close to the root meaning of one of the short and uncomplicated words of the English language, *kindness*.

Jimmy Taylor, who attends the Mill Plain School in Fairfield, Connecticut, although only thirteen years old, feels such a kinship with Nature. This is Jimmy's story of his partnership with four homeless raccoons as told in a school essay, which won him an A.

MY NAME is Jimmy Taylor. I am thirteen years old, and my hobby is raising raccoons. I have four raccoons, and their names are Davy, Daniel, Billy and Buster.

My father and I got them at a fire one night. It was during a lightning storm and a barn caught fire. We went to the fire, and while the firemen were fighting the fire, they heard a noise. Nobody knew what it was, so two firemen went into the barn to see what it was, and when they came out they each had two raccoons. No one wanted them so we took them.

The baby raccoons were two or three weeks old. They just about had their eyes open. We brought them home and put them in a cardboard box for the night. The next morning when we woke up, we heard a noise. We thought probably they were hungry and they were, so we gave them some warm milk from an eye-dropper.

When they were about four weeks old, we fed them from a baby bottle. Then when they were about ten weeks old, they ate by themselves. By that time they were getting pretty rough and nosy. They would stick their paws in every little hole. Pretty soon we had to build a bigger cage for them. Now they weigh about twenty pounds each and if you wanted to pick them up you would have a tough time. You have to handle them gently. I take my raccoons out for walks all the time. I take them to fairs, too. So far I have won first place.

They say that raccoons hibernate in the cold months, but it really is not hibernation. It is just that their heart-beat slows down and they are less active. They just lie around. When the raccoons eat out in the wild they wash their food. They are a relative of the bear.

A raccoon or any animal will be nice to you if you are nice to it.

## Against Pollution

A new pulp mill of the Weyerhaeuser Timber Company at Cosmopolis, Washington, will have a waste-treatment system that will remove ninety-two percent of the river-pollution load of a sulfite mill, according to Conservation News, of Washington, D.C.

## For Classroom

Pat Dowling Pictures, 1056 S. Robertson Boulevard, Los Angeles 35, California, has available, among its new classroom color films "The Ladybird Story," "Earthworms," and "Toads" in the category of Nature study and science films.

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# Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

## The Clan Paramecium

WITH CERTAIN GROUPS of animals it is customary to learn to know species, if one becomes sufficiently interested. Thus, no one would dream of learning birds only as to their family or genus, and the advanced bird watcher prides himself on his ability to distinguish the more difficult kinds—those with closely similar pattern or coloration. This is true also of fishes, amphibians, reptiles, and the more conspicuous mammals. The butterfly and moth collector can glibly rattle off the names of his pinned specimens; your conchologist friend can run through the names of his shells with ease. When it comes to beetles, most of us feel we are doing fairly well if we can identify the family. "That's a staphylinid," or "Here's a chrysomelid," we say.

In the case of most invertebrates below mollusks, we will settle for the generic name and pay no attention to either family on the one hand or species on the other. To the average field student, all earthworms are *Lumbricus*, for that is the one he studied in laboratory. We take a course in general zoology and learn *Hydra*, *Obelia*, and *Planaria*, and come to regard these designations in the same way that we treat species among vertebrates. Notably is this so in the protozoa, for most of us never see more than a single species from any one genus. Are not all amoebas alike? All paramecia?

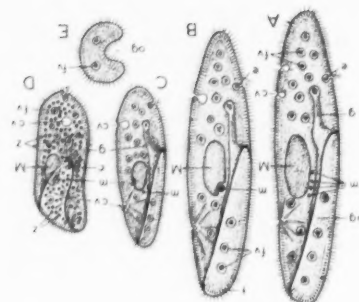
Undoubtedly the most widely known and generally studied of all unicellular organisms is paramecium. No one escapes any sort of introductory course in high school or college biology or zoology without being exposed to an acquaintance with this ubiquitous creature. It so happens that the genus *Paramecium* is also an ideal type with which to demonstrate that there are different kinds, in the same way that there are different species of warblers of the genus *Dendroica*, or frogs of the genus *Rana*. The owner of a microscope, or those using school

microscopes, can undertake this study with ease, as the characteristics by which the different species of paramecia are told apart are no more difficult to understand and to see than are the means of distinguishing members of the genus *Felis*.

## Taxonomic division

First let us locate the group in its frame of larger taxonomic divisions. Those protozoans that progress by means of cilia are placed in the Subphylum Ciliophora and Class Ciliata or Ciliata, these last two corresponding to the well-known older term, Infusoria. Ciliates are next divided into either the Subclass Protociliatia, in which there are two to many nuclei, all of the same kind, as in *Opalina*, or the Subclass Euciliatia, members of which have two kinds of nuclei, macro- and micro-, as in *Paramecium*. Next come the orders, and in the Order Holotrichida, or Holotricha, the ciliation occurs all over the body and all the cilia are approximately of the same length. There are a number of other orders in which the members have specialized cilia, not uniformly distributed. *Paramecium* is a holotrich, and as it has a cytostome (mouth) located in a peristome (oral groove), provided with special rows of cilia, it is placed in the Suborder Trichostomina (or Trichostomata), in which the families number fourteen (Kudo) or fifteen (Hall). The Family Parameciidae, members of which have the peristome extending from the anterior end back to about the middle of the cell, includes the genus *Paramecium* and possibly one other.

In this genus *Paramecium*, Kudo, the famous University of Illinois Japanese protozoologist, now at Rutgers University, lists nine species; other authorities say at least nine, possibly ten, and of course there is always the likelihood of a new one turning up from some region not yet thoroughly explored. But nine will serve well for our purposes, and only four of these are to be classed as common. The first thing to look for, if



The four most common species of *Paramecium*. A. *P. multimicronucleatum*, 200-350 $\mu$ ; four or more very small vesicular micronuclei, visible only in well stained specimens; 3 or more contractile vacuoles. B. *P. caudatum*, 180-300 $\mu$ , slightly more pointed posteriorly than *P. multimicronucleatum* or *P. aurelia*; one compact micronucleus which is in a pocket in the macronucleus and which can easily be stained with methyl green; two contractile vacuoles. C. *P. aurelia*, 120-180 $\mu$ , quite rounded posteriorly; two very small vesicular micronuclei visible only in well stained specimens; two contractile vacuoles. D. *P. bursaria*, 100-150 $\mu$ , cell flattened, truncated anteriorly; single compact micronucleus; numerous zoochlorellae which make the organism appear green. E. Cross section of any of the three organisms shown in A, B, and C taken through the middle of the oral groove. c, cytostome; cv, contractile vacuole; e, food vacuole emptying through the anal spot; fv, food vacuole; g, gullet; m, micronucleus; M, macronucleus; t, trichocysts; z, zoochlorellae. (A-D, after Wenrich). Reprinted from Jahn & Jahn, *How to Know the Protozoa*, through the courtesy of the authors and the Wm. C. Brown Co., Dubuque, Iowa.

the student has under his lens a specimen that he believes to be a paramecium, is the general body shape, of which there are two sorts, the *aurelia* and the *bursaria*. Most of us have cut our protozoological eye teeth on one of the aurelia type of species, which has a characteristic shape exemplified by the species *Paramecium aurelia* (see illustration), and it will be either this species or *P. caudatum* or *P. multimicronucleatum*. All agree in being slipper-shaped, a form that has lent its name to the whole genus, as they have been called the "slipper animalcules." This shape may appear that of a cigar, more or less cylindrical, with tapering ends or, according to the view presented at any given moment, that of a shoe sole, with the front



end bluntly rounded, narrowing a bit behind, then expanded to the widest extent just beyond the middle, thence tapering to a more pointed posterior extremity.

### Species descriptions

*P. aurelia* is much the smallest of the three. It is less than 180 micra in length and is rounded at the rear end, with two contractile vacuoles, with radiating canals, and two compact micronuclei, one of which is embedded in a depression of the very large macronucleus.

The other two species of this type are the largest of the genus, up to 300 micra in length. *P. caudatum* (200-260 micra) is the one most commonly studied. If paramecium cultures are ordered from a supply house, it is usually this species that is sent for general study. It is somewhat more pointed posteriorly than *multimicronucleatum*, has two contractile vacuoles, with radiating canals, and a single, relatively conspicuous, compact micronucleus, indented in the macronucleus. *P. multimicronucleatum*, as the name indicates, has a larger number of micronuclei, commonly four, sometimes more. These are described as *vesicular*, contrasting with the usual solid or compact form, and indicating that they appear largely empty (*vesicle*, bladder). This species has generally three and not infrequently more, up to seven, contractile vacuoles, each with canals. The micronuclei cannot be seen in living animals, as a rule, but are brought out by staining with methyl green.

*Paramecium bursaria*, from which the second group takes its name, has a cell shape like that of animals in the genus *Bursaria* and is green in color, due to the presence of numerous *zoochlorellae*. These are minute green algae that live symbiotically within the endoplasm and contain chlorophyll. They manufacture carbohydrates, the excess being transferred to the protozoan partner, from which the algae receive protection and also transportation to places where light is available. *P. bursaria* has two contractile vacuoles, with canals, and a single compact micronucleus.

If the specimen has a bluntly rounded form at both ends, characteristic of this type, but is not green in color, then it belongs to one of the remaining five species, all rather rare. *P. woodruffi*, *polycarum*, and *calkinsi* each have two contractile

vacuoles, with radiating canals. *P. woodruffi* ranges from 150 to 210 micra in length (sizes from Kudo) and has three to four vesicular micronuclei; *P. polycarum* is 70 to 110 micra, with three to eight vesicular micronuclei; *P. calkinsi* is 100-130 micra and has two vesicular micronuclei.

*P. putrinum* has an elongate, sausage-shaped macronucleus, a single compact micronucleus, and only one contractile vacuole, central in position, slow in operation, and without canals. *P. trichum* is the smallest species, 70 to 100 micra, oval in shape, with two contractile vacuoles that are without canals, and one compact micronucleus. All species of the genus are found in fresh water except *woodruffi*, which occurs in brackish water. *P. calkinsi* is found in both fresh and brackish waters.

### Trichocysts carrot-shaped

All paramecia have trichocysts lying beneath the pellicle (*t* in the illustration), which are carrot-shaped in the living animal, but when ejected become long threads or rods. Their function is unknown. It has been suggested that they ward off predators or that they anchor the animal while it is feeding on bacteria. The Jahns describe a very interesting staining procedure for demonstration of both trichocysts and cilia. To several drops of a rich paramecium culture on a slide add one small drop of red record ink, wait five minutes, and place on a cover glass. If the animals are dead, start over and use less ink. Then add a drop of permanent blue-black record ink at the edge of the cover, which will cause the discharge of the trichocysts as it diffuses through the preparation, and will kill the paramecia. The result should be blue trichocysts and red cilia.

A standard procedure in the laboratory in order to observe feeding is to add some finely ground bits of carmine, as from rouge, to the culture on the slide. The paramecia will engulf these just as they do bacteria, and the bright red particles can be followed into food vacuoles and their subsequent cyclosis (circulation) around the cell to their eventual elimination through the cytopygge (anal opening).

In previous issues we have reviewed a number of standard works on the protozoa, and list them here again for convenience of reference, along with others.

Hall, R. P., *Protozoology*. Prentice-Hall, New York, 1953. Reviewed in this issue.

Hyman, Libbie H., *The Invertebrates: Vol. 1, Protozoa through Ctenophora*. McGraw-Hill, New York, 1940. Reviewed Oct., 1940.

Jahn, T. L., and F. F. Jahn, *How to Know the Protozoa*, one of the Pictured-Key Series. Wm. C. Brown Co., Dubuque, Ia., 1949. Reviewed April, 1956.

Kudo, R. R., *Protozoology*. Charles C. Thomas, Springfield, Ill., revised edition, 1939. Reviewed, Dec., 1939. The latest edition is the 4th, 1954.

Other references that may be consulted by those who find interest in this study:

Beale, G. H., *The Genetics of Paramecium Aurelia*. Cambridge University Press, 1954.

Calkins, G. N., *The Biology of the Protozoa*, 2d ed. Lea & Febiger, Philadelphia, 1933.

Sonneborn, T. M., Sex, sex-inheritance and sex determination in *Paramecium aurelia*. Proc. Nat. Acad. Sci., Vol. 23, 1937.

—Partner of the Genes. Sci. Amer., Vol. 183, No. 5, Nov., 1950.

Wenrich, D. H., Eight well-defined species of *Paramecium*. Trans. Amer. Micr. Soc., Vol. 47, 1928.

Wichterman, R., *The Biology of Paramecium*. The Blakiston Division, McGraw-Hill, New York, 1953.

Woodruff, L. L., *Paramecium aurelia* in pedigree culture for twenty-five years. Trans. Amer. Micr. Soc., Vol. 51, 1932.

### NEWS and NOTES

Supplementing our historical sketch of the great optical works of E. Leitz, Inc., we have learned of the death of Ernst Leitz, the second, in June, 1956. Our concluding installment in the October, 1956, issue was written at about the time of his passing, at the age of 85. Three sons survive, the eldest being the third generation to bear the honored name of Ernst Leitz.

If you have a home laboratory, save your instant coffee jars and use them as tall Stenders and for storage of clean blank slides and dry materials. Many products now come in a version more or less that of the flat Stender—cold creams and deodorants, for example—suitable for paraffin embedding and small article storage. We find nothing better for

use as a cover glass container than the circular metal and plastic boxes in which you buy your new typewriter ribbons, especially the transparent plastic jobs with fit-over or pill-box type lids.

Eric Sobotka, proprietor of The House of Microscopes, and one of our best known importers of Euro-

pean optical instruments, has moved to a new location. His showroom and office are now at 110 West 40th St., New York 18, N. Y., Suite 2101, telephone Wisconsin 7-9216.

Something happened in the processing of our notice of B & L's new *Macroscope* in the April issue. The description refers the reader to an

accompanying illustration, for which he may search in vain. Alas for the poor illustration! It must have gotten upon the cutting-room floor in some unfathomable manner, and was thwarted in its effort to fulfill its mission. [It was lifted at the last moment for an advertisement. Here it is, a trifle late. Ed.]

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## Book Review Protozoa

Since our feature this month concerns *Paramecium*, this is an appropriate time to call your attention to one of the newest and best works on the protozoa in general. This field is not overcrowded with texts and so a new one is a welcome addition. *Protozoology*, by R. P. Hall, of New York University, covers the subject with admirable thoroughness and is well written and illustrated. Chapter headings, aside from the taxonomic consideration of all groups, include such topics as morphology, physiology, life cycles, reproduction and heredity, and conclude with five chapters on the parasitic forms, an entire one devoted to malaria. The introduction to classification reviews the history of attempts to organize this large group of animals; each chapter is well documented with citations to literature; and there is a good index. The latest findings on such research frontiers as the physiology and genetics of the higher protozoa are incorporated.

Pp. 682, figs. 264, with thousands of separate drawings. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1953. \$10.00.



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